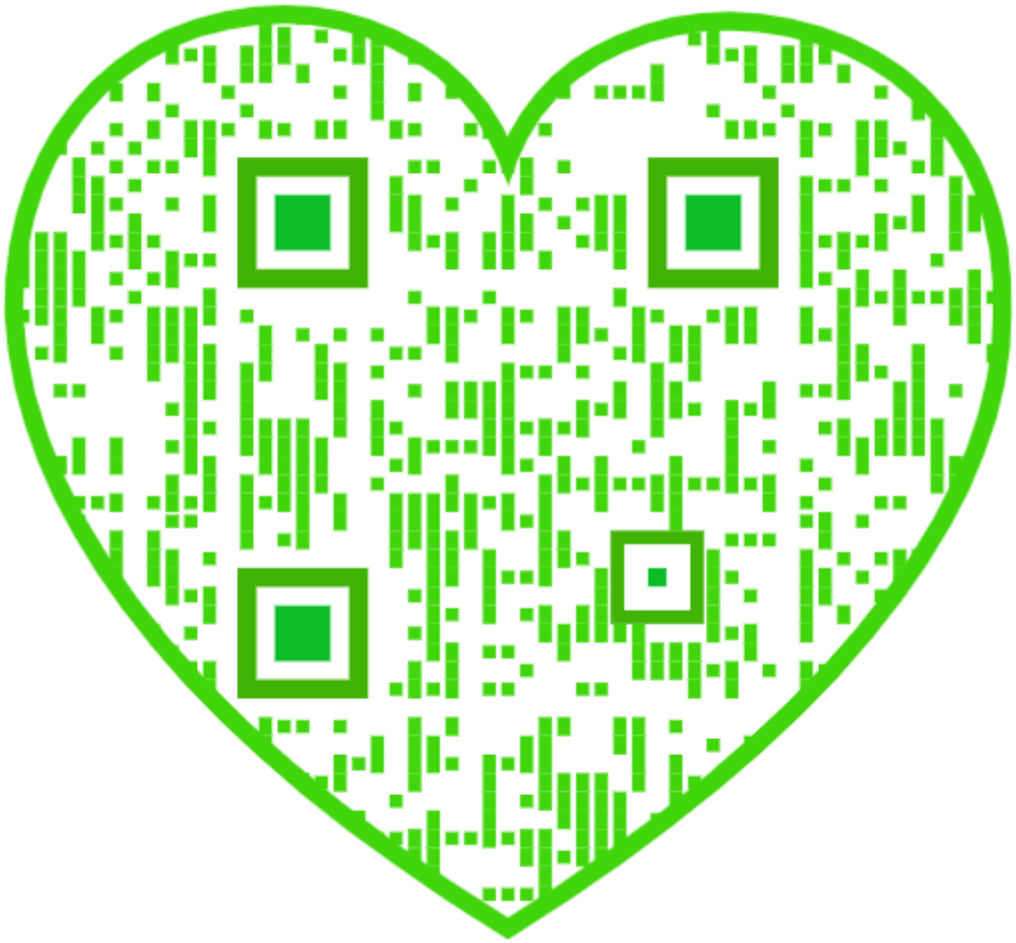

PRACTICAL

SHEET METAL WORK

AND

DEMONSTRATED PATTERNS

A COMPREHENSIVE TREATISE IN SEVERAL VOLUMES ON

SHOP AND OUTSIDE PRACTICE AND PATTERN DRAFTING

VOLUME VII

PRACTICAL CORNICE WORK

COMPILED FROM THE

METAL WORKER

PLUMBER AND STEAM FITTER

EDITED BY

J. HENRY TESCHMACHER, JR.

DAVID WILLIAMS COMPANY

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PREFACE

IT is confidently expected that Volume VII of PRACTICAL SHEET METAL WORK AND DEMONSTRATED PATTERNS, devoted to practical architectural sheet metal work, will fill a long felt need for a book that elucidates practical methods of the trade. In the two volumes preceding this one there are presented valuable pattern problems in the category of cornice work and practical ideas; especially in Volume VI, where methods for developing patterns and making circular cornice work are exemplified. Making in all, a fund of information of incalculable value.

As stated in the preface of the other volume, throughout its existence METAL WORKER, PLUMBER AND STEAM FITTER has had the services of experts in the lines the paper represents. This has been notably so in the Sheet Metal and Pattern Drafting departments. The experience of these experts has been utilized to answer queries of readers who, having a problem they cannot solve, resort to the columns of that journal. In addition, many readers have contributed ideas, methods of procedure and little time-saving kinks of decided interest to the trade. Naturally then, a large collection of everyday problems has resulted and with the assurance by numerous inquiries that in book form these solutions would be invaluable, they are compiled in a series to be known as PRACTICAL SHEET METAL WORK AND DEMONSTRATED PATTERNS.

Inasmuch as in a compilation, the work of many authors is selected, some under a pseudonym, no authorship can be given to these series; the matter coming from a journal of unquestioned authority should be ample recommendation. To the unknown contributors sincere appreciation is expressed by the publishers, and to those who are known, H. Collier Smith and William Neubecker, especial thanks are due.

J. HENRY TESCHMACHER, JR.

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Practical Sheet Metal Work and Demonstrated Patterns

ESTIMATING COST OF SHEET METAL WORK

Estimating is the most difficult branch of sheet metal work, and no man can take a set of plans and specifications and estimate the cost of all the sheet metal work in the building correctly.

Inasmuch as it is an important feature of a sheet metal working establishment the views of two writers on this subject are here reprinted.

The cost of a given job, if it were executed in different shops in the same city, under the same scale of wages, or in the same shop at different times, would vary materially. The personalities of the boss, foremen and workmen enter into the equation. The same work executed in different shops in different cities under different labor conditions will vary widely. All this applies mostly to the item of labor, although the amount and quality of material would vary occording to the ideas and degrees of integrity of the contractors who execute the work. The estimate of cost made up by different men of the work covered in a given set of plans will vary from 1 to 50 per cent., and it is impossible to lay down any rules that will result in uniform estimates by different men; the reasons for this condition are many and varied.

If all architectural and engineering drawings and specifications were governed by uniform rules, as all drawings and specifications for patents are, estimating would be simpler and more uniform, but the personality and diverging ideas and practices of architects, engineers and draftsmen result in different methods of showing and describing work of similar nature, and is consequently susceptible of different interpretations by estimators. It is seldom that the drawings and specifications of all the work in a given building agree. Most architects have a general or stereotyped form of specification which they modify to suit different kinds of work, and in making the modifications many points are overlooked, so that the specifications often mention work which is not shown on the plans, or the plans show work not mentioned in the specifications, or the plans and specifications differ as to the same work. For instance, flashings may be marked "copper" on the plans, while the

specification calls for tin, zinc or galvanized iron, or vice versa, and often neither plans nor specifications are clear as to what is really required, making it necessary for the estimator to use his own judgment.

It is seldom safe for the estimator to offer to do the various lines of sheet metal work on a building "in accordance with plans and specifications," unless he has made allowance for all contingencies, and if such allowance has not been made he is apt to be called on to do work which he did not figure on, which diminishes or possibly destroys the profit. If the estimator offers to do the work "in accordance with plans and specifications" and makes allowance for all possible contingencies, the chances are that the work will be awarded to a competitor who has not made such allowance, the bidder taking chances as to what he will be required to do. The only safe course is for the estimator to specify in his bid just what he had figured to do.

In order to illustrate the difficulty in arriving at a close estimate of the cost of a cornice, for instance, we will start with the taking off of quantities. In most cases all that the estimator has to figure from is a $\frac{1}{8}$-in. or $\frac{1}{4}$-in. scale drawing, which gives a more or less vague idea of the projection, hight and profile of the cornice. From that he must guess at its girth and supporting construction. As a rule, the specifications provide that the cornice must be made in accordance with full size details which are to be furnished later by the architect, and it often happens that while the scale drawing shows a plain molded cornice with plain modillions, egg and dart and dentil courses, the full-size drawing will show a differing profile with elaborate paneling, ornamented soffitt, etc., requiring considerable more material and labor than the scale drawings indicate will be required. Or in the case of a bay window the scale drawings may indicate plain paneling and simple construction, whereas the full-size details may show considerably more work and material. Furthermore, the architect may be very exacting and insist that a cornice that is to be put up at a greater or less hight, and in which small and immaterial defects and inaccuracies will not be noticed when the cornice is up, shall be made as perfect and clean as though it were to be put in a showcase for exhibition purposes within two feet of the eye.

Then when it comes to putting the cornice up on a building, the presence or absence of scaffolding or the condition of the building, co-operation or lack of co-operation of carpenters and masons, weather conditions, etc., materially affect the labor cost. And they are all conditions impossible of determining upon beforehand with any degree of certainty. In tall buildings the question of the hoisting of material is an important consideration, as it is necessary to use the elevator operated

by the general contractor for hoisting the other building material, and special arrangements must be made for hoisting the sheet metal work at certain times, and the charges for this service are unusually high.

No man is capable of estimating on sheet metal work who has not a very good general knowledge of building construction and has not had sufficient experience in the particular locality in which he is estimating to be acquainted with the common practices and customes of architects and builders there. He must be thoroughly familiar with the particular branch or branches of work on which he is to estimate, and must be capable of judging, or know either from personal experience or from records kept by the concern for which he is figuring, about what such work will cost or has cost before. There are various methods of estimating. The writer knows of one large concern, the head of which seldom writes down any items on standard work, such as school houses, apartments, etc.; he merely glances over the plans and specifications and makes a lump sum guess on the spot, and the concern is successful; other concerns have a scale of prices for standard work arrived at by experience, and they take off the general items from the plans and put the price opposite each item.

Another method and best of all—in fact, the only proper method of estimating—is that of carefully taking off the items from the plans and estimating the amount and cost of material and the cost of labor separately, to which is added the percentage of fixed charges for doing business, such as nonproductive salaries, rent, depreciation, insurance, etc., thus arriving at an estimate of the actual cost of the job, to which is added the profit, the amount of this being governed by the size of the job, the footing on which they stand with the builder, architect and owner as affecting their chances of getting the contract, etc. In order to illustrate how quantities are listed under the second method above mentioned, assume that the cost is to be be estimated of a No. 24 galvanized iron cornice 50 ft. long, with end blocks. The whole cornice is to be supported on angle iron brackets built in or secured to the wall, and to be ornamented by modillions, egg and dart molding and dentil course. This would appear on the estimate sheet as follows:

50 ft. 24 G. I. cornice, 7 ft. girth, on angle iron brackets, end blocks, modillions 6 × 12 × 5 face, 4-in. egg and dart, and dentils, at $2.66..... $133.00

The same item listed in accordance with the third method mentioned would appear on the estimate sheet as follows:

50 ft. No. 24 galvanized iron cornice, 7 ft. girth, with end blocks, modillions, egg and dart, and dentils. Angle iron brackets.

	Material.	Labor.	Price.
48 ft. molding, 7 ft. girth, = 432 lb., at 4 cents.....	$17.28	....	....
24 stamped zinc mod., 6 × 12 × 5 face, at 25 cents...	6.00	....	....
50 ft. 4-in. egg and dart, at 10 cents	5.00	....	....
48 ft. dentils, 5-in. high by 4-in. face by 3-in. deep, 50 lb., at 4 cents.....	2.00	....	....
2 end blocks = 60 lb., at 4 cents.....	2.40	....	....
2 6-in. stamped ornaments in end blocks, at 25 cents	.50	....	....
350 lb. angle iron brackets and braces, at 3 cents...	10.50	....	....
Solder, bolts, rivets, fuel, etc.....	3.00	....	....
Totals.....	$46.68	$60.00	$133.35

Referring further to the third method, each different piece of cornice, roof, gutter, etc., is listed in the same way—that is, a general statement is made as to what the piece of work consists of, and it is then itemized to get at the different kinds and amounts of material used and the amount of labor involved, by using three colums to the right of the estimate sheet, in the first of which the cost of material is placed, and in the second the labor cost, and in the third the price. It is easy to foot up separately these three factors so that the estimate will show at a glance not only the cost of labor and material separately for the whole job, but will show the same factors of each item, so that if any changes are desired, as is generally the case, it is a simple matter to deal with any item separately.

ESTIMATING COST OF SHEET METAL WORK—II

In estimating on any form of sheet metal work, whether in the line of heating and ventilating pipes or architectural sheet metal work, there are four distinct items of cost, which may be considered under four headings, viz.: 1, Material; 2, Shop Cost; 3, Transportation, and 4, Erection. Before considering either of these, the common methods of calculation now in vogue will be briefly referred to.

If an ordinary cornice is taken, for example, at first impression a person would be inclined to describe it as simply a combination of galvanized iron and labor. Assuming this, it can be readily argued that an average gauge of galvanized iron costs about so much per square foot. Comparing one thing with another one presumes to estimate the labor of making, putting up, etc., including the small incidentals of solder and rivets, at so much per pound, or square foot, as the case may be; and therefore concludes that cornice work is worth so much per foot, and this is believed to solve the entire problem of estimates. Any one who will

give the matter a moment's thought will see that there must be a fallacy lurking at the bottom of such estimates.

Compare a planceer with an elaborate bracket, or a common crown molding with a panel finished with ornamental or incised work, or the plain covering of a belt course with a curved molding, and it at once becomes apparent that a calculation based upon an average cost of labor, proportioned to the quantity of material, will be very considerably out of the way in some cases, if not generally wrong. It will be found almost impossible even for a man of the greatest experiencc and practice, to discriminate intelligently, at the time of a hurried calculation, between the cost of labor per square foot of material upon very plain work and the cost upon elaborate work. The change from one extreme to the other will, for the moment, mislead the best mechanics. By practice and experience, when confined to a range of work not too extended, a mechanic may drill himself in estimates until, with no other guides than his judgment, he almost reaches perfection.

To estimate intelligently upon a job of sheet metal work, a man must, by memory or judgment, be able to analyze the work into its elements of material and labor, subdivide these again until all the prime factors are reached, and then, by pricing in detail and recombining, get his price-list for the job.

Now consider the four elements of cost as they were stated above. As to material, a careful examination of the drawing from which quantities are to be taken, shows that there are combinations of moldings, brackets, modillions, dentils, frieze pieces, trusses, etc. Now, knowing the scale to which the drawing has been made and assuming it to be ¼-in. to the foot, as is generally used, set the dividers equal to, say, 2 inches by the ¼-in. scale, and obtain the stretchout, or girth, from the ¼-in. scale profile or section of the cornice. Assuming this to be 4 feet, multiply this by the number of feet of cornice required, and the result will be the number of square feet of the cornice proper. In a similar manner obtain the number of square feet of material for the fronts and sides of the brackets, modillions, dentils, etc. Then, multiply the entire number of square feet of metal by the price per square foot, which gives the total amount for metal.

In the same way obtain the price for the iron lookouts, also make a price for the solder, rivets and coal, which good judgment and experience can readily determine. Where pressed zinc ornaments are shown estimates are obtained direct from the dealer in pressed zinc work, or sometimes a trade catalogue will give the desired styles and the prices of all such items. Adding all this together will give the net cost of materials.

Now as to the second element, shop cost. This requires practical experience on the part of the one who makes these prices. He should know how long it will take to make the plans, details, etc., and develop the patterns for the cornice, to prepare the sheets ready for bending, and how many feet a man and boy can brake up in a day. He must also know how many brackets, modillions, panels, dentils, lookouts, etc., can be made in one day and the amount of labor it will require to construct the cornice in the shop, if that is necessary, because some cornices are crated in parts and put together on the job. Adding all this together will give the net amount of shop cost.

But in considering each of these parts in turn it is discovered that they admit of being grouped into certain general classes, which can be referred to when again estimating on similar kinds of work. Restricting ourselves to ordinary forms in common use, all crown moldings are of such a nature that they are of substantially one price, varying only by the girth and gauge employed. The same is true, likewise, of planceers, modillion and dentil courses, foot moldings, etc.

Brackets and modillions may be classed by their shape and design. All brackets and modillions of plain face and plain sides will belong to one class, having a common cost price and varying only as the size differs. The same is true of brackets with more elaborate patterns. Frieze pieces, or panels, may be similarly classed. Plain panels with square ends may be one class, while panels with curved ends, or round centers, diamond centers, etc., will constitute another class.

What is true of cornices, in respect to analysis, is equally applicable to other items in sheet metal work, such as piping, elbows, drums and ducts, as commonly used by manufacturers of heat and vent pipes. If in doubt as to the necessary amount of labor required to a given article, experiment to demonstrate the cost. Armed with these at the time a calculation or estimate is to be made, the work is easy, straightforward and accurate, and although made by different men upon the same work the estimates will compare closely.

Having ascertained the shop cost of any given piece of work, consideration will be given to transportation. The cost of transportation, although varying very much between different points on account of relative distance, is never a very heavy item. Therefore, freight may be estimated by a price per hundred-weight or bulk, according to distance.

Another important item in estimating is that of erection. The putting up of the work is to be estimated by a careful consideration of the shape, size and proportions of the buildings, advantages of scaffolding, the class of workmen employed, their knowledge and experience, and, last but not least, the manage-

ment by which they are controlled. It is often the case in shop work, as well as in the work of erection, that there is great loss of time and labor, because the foreman in charge is not able to control the men and thereby obtain the greatest amount of labor from them.

When preparing a price-list which can be used when estimating round or square piping, it is only necessary to know the labor or time required to make a given number of feet of pipe or elbows, together with the girth of the pipe, which is multiplied by the length required, thus giving the number of square feet of surface. The number of square feet is again multiplied by the number of ounces in a square foot, the product of which is then divided by 16, resulting in the number of pounds of metal required, which is then multiplied by the price of iron per pound. It will be seen, therefore, that a list can be easily established giving a certain price per pound per square foot, or per lineal foot in pipe work, which would be impossible in a completed cornice.

Thus, knowing the cost of materials, shop labor, transportation and erection, these items are figured in one lump sum, to which is added the percentage of profit desired, which completes the estimate.

In estimates made to fix a price at which a job is to be executed too great care cannot be taken in obtaining exact information as to the requirements from the specifications. A specification which is not clearly written, and where information must first be obtained by personal conversation with the architect, is of no value whatever on a large contract, for in case of any dispute the contractor is not able to say that he is following his specification, because the chief points are omitted. In this connection a model specification is presented on a roofing and sheet metal job, giving specifications for copper galvanized iron, tin, slate and ventilating duct work, which may be of value to some readers in preparing specifications for first-class jobs.

SPECIFICATIONS FOR THE SHEET METAL WORK

DIMENSIONS

All dimensions and the general arrangements of the building are to be obtained from the plans. The general plans of the building are drawn to a scale of ¼ in. to the foot. Large scale and full size detail drawings will be furnished at the time of estimating and during the progress of the work, and are in all cases to take precedence over the ¼-in. scale drawings.

MATERIAL AND WORKMANSHIP

All materials used are to be of the best of their several kinds. The work throughout is to be done in the best and most workmanlike manner,

under the direction and to the entire satisfaction of the architect, who shall have power to reject all material or work which does not conform to the true intent and meaning of these plans and specifications.

GENERAL REMARKS

The contractor is to give his personal superintendence to the work, and is also to keep a competent foreman continually at the job, from the time when the work under his contract is begun until the final completion of the same. He is to comply with all laws and ordinances relating to buildings, etc., and is to be responsible for any violations of the same caused by himself or his employees. He is to be responsible for his own work and materials until the final completion of the building, and must replace with new any of the material which may be stolen or become damaged, without extra cost to the owner. He is to thoroughly protect and keep the building water-tight and storm-proof, and guarantee his work for two years after the final completion of the building.

COPPER WORK

The gutters on the rear and all leaders are to be made of 20-ounce cold rolled copper. The gutters are to have brass wire beaded edges, and are to be supported on 3-16×1-inch band brass hangers, spaced not over 30 inches apart from centers, and secured to the wood work with two heavy brass screws to each hanger. Across the top of the gutter have twisted braces made of ⅛×¾-inch band brass, secured to the front edge of the gutter and screwed fast to the wood work with two brass screws to each brace, the braces to be spaced not over 30 inches apart, and to be located centrally between the hangers under the gutter.

The leaders are to be square in form and in number and size as shown on the plans, and are each to be fitted with a molded box head, properly connected to the gutter, with a heavy copper strainer over the inlet; to be secured to the wall with ⅛-inch thick cast or wrought ornamental hinged holdfasts, spaced about 12 feet apart vertically, and fastened with heavy round-headed brass nails. The leaders to have a special cast-iron shoe at the bottom, with bend to throw the water over the ground, or to be connected to the sewer, and furnished by the plumber, as may be directed. The joint between the leader and the cast-iron pipe to be made with oakum and molten lead; this to be done by the plumber.

The saddle and flashings around the chimneys are to be of 16-ounce cold rolled copper. When the copper is to be connected with the galvanized iron or tin work, the copper is to be thoroughly tinned on both sides at a distance of 2 inches along the edges.

GALVANIZED IRON WORK

All cornice, hip moldings, deck moldings, dormers, ventilators, skylights, etc., as indicated on the plans, are to be made of No. 24 best bloom

galvanized sheet-iron, with all vertical and horizontal joints closely riveted and heavily soldered, and set up perfectly straight and true.

All cornices into which gutters are to be lined are to have ¼×1¼-inch wrought-iron braces on the inside, placed not more than 30 inches apart; to be well painted with metallic paint before they are inserted in the cornice, and the gutters are to have heavy angle irons in the upper edge of the cornice. All are to be well painted with metallic paint before insertion. The braces across the top of the gutter to be of ¼×1¼-inch twisted galvanized wrought-iron spaced not over 30 inches apart, secured to the angle iron by means of galvanized bolts, nuts and washers, well bedded to red lead, and secured to the roof planking with two heavy screws to each, and to have a cap soldered, over the head of each bolt, and made perfectly water-tight. The dormers and ventilators are to be securely braced with heavy wrought iron, to be galvanized in all cases where it is exposed.

The cornices are to be ornamented as indicated on the drawings. The hip molds are to have beaded flanges, to be secured to the wood cores with ¼×1¼-inch galvanized iron clamps, fastened with two heavy brass screws, one on each side. The skylights are to have condensation bars with iron cores, glazed complete with ¼-inch thick wire glass, and to be left whole and clean at the final completion of the building.

TIN ROOFING

All roofs, as indicated on the plans, are to be covered with — roofing plate cut to 10×14-inch size, painted on the under side, and laid on one thickness of two-ply rosin paper, with all joints locked, cleated and heavily soldered, and to be well flashed to make a complete water-tight job.

All gutters are to be lined in the same manner as described for roofs, thoroughly locked and soldered to the top edge of the galvanized iron cornice. The steep portion of the roof near the skylights to be laid with standing groove seam, the seams being thoroughly bedded in red lead. Paint all tinning with three coats of metallic oil paint, the first coat to be put on from day to day, as the roofs are laid, and the two additional coats to be put on as directed.

SLATE ROOFING

The steep roofs, as indicated on the plans, are to be covered with 16×8-inch slate, all to be of uniform color and even ¼-inch thickness, laid on heavy tarred roofing felt, in straight regular courses, to show not over 6½ inches to the weather, and each slate to be nailed with two fourpenny yellow metal slaters' nails. The hips and the sides of the dormers to be step-flashed with 14-ounce soft copper.

VENTILATING DUCTS

Have the required ducts and flues to ventilate all rooms, etc., as indicated on the several drawings, made of No. 24 best bloom galvanized

sheet-iron, well secured to the partitions and ceilings, and to be connected to the brick vent flues with flanges, air-tight joints, and fitted with the required flanged outlets for registers. Connect the brick flues with metal ducts of the full area of same to large air-tight chambers in the attic, fitted with water-tight floors and doors complete; all to be made of No. 20 galvanized sheet-iron and connected to the ventilators on roof, which are to be of Emerson pattern. All work to be thoroughly braced with wrought-iron.

While the above specification could be made still more explicit, it is believed it will be generally understood. In estimating on work of this kind the same rules are applicable as explained before, with the exception that it would be necessary to know the number of ounces per lineal foot in the brass band and wire above referred to, also the weight of the angle and band iron, and the price per square foot of wire glass for the skylight.

The skill and knowledge required in an estimate, then, is reduced to about this: Sufficient familiarity with architectural and mechanical principles to enable one to know and comprehend the construction, and sufficient familiarity with the management of outside work to judge correctly of the labor and expense attendant upon the putting up of the given work, and to estimate upon the cost of transportation. No rule can be laid down to which there will not be found some exceptions. The unending variations and changes in architectural sheet metal work are continually bringing up some new features, new constructions, new shapes and new combinations. Judgment and care, however, will overcome all these difficulties.

One of the first things a beginner in estimates will require to learn is to make a correct list of the quantities and parts, and then he will have to use good judgment in deciding results. Careful study in this branch is attended with the same beneficial results as are attention and care paid to any other business matter.

KEEPING TRACK OF COSTS

The following system affects the entire filing system of an office, which will be briefly considered.

Exclusive of the regular creditors', customers' and general ledgers, cash book, stock books, etc., all data relating to estimates, orders and costs should be kept on separate sheets of paper, specially printed for their particular purpose and filed in cabinets under a card index system. There should be a file devoted exclusively

to estimates, all estimates being numbered and filed consecutively. There should be alphabetically arranged index cards for the estimate file, giving the name, location and number of each estimate or job figured, so that when it is necessary to look up the estimate for the Tom Jones Building, reference to the alphabetical index card marked "Tom Jones Building" will reveal the number of the estimate, thus making it easy to find in the file. There should be similar files for orders, so that changes, additions, extras, etc., can be readily made on separate sheets and attached to the original sheet or sheets, and each of the respective sheets mentioned hereafter should be filed separately in the same manner. The first to be considered is labor cost:

J. CORNIZE & CO., NEW YORK

DAILY TIME CARD

Date Dec. 14 1910 | Rate 30¢

Name John Brown

JOB NUMBER	KIND OF WORK DONE	IN or OUT	HOURS	AMOUNT	
464	Dentils	I	4	1	20
464	Modillions	I	2		60
740	Conductor	O	2		60
740	Car fare				20
Totals			8	2	60

Fig. 1. Actual Size of Card, 3 × 4 Inches

Each employee should be furnished with daily time cards, like that given in Fig. 1, and should be required to fill in the indicated data and deposit the cards daily in a box provided for the purpose, from which they should be taken by the foreman and passed on before being handed into the office. If working outside, the cards should be mailed or sent to the office daily. The back of the daily time cards should be left blank for the use of employees in recording remarks or reports.

It will be seen that the card makes provision for date, name, number of job, kind of work, whether inside or outside, number of hours worked, and amounts of money. A number of spaces are allowed for keeping time on different jobs worked on during the same day.

The time and expenses on the various jobs thus collected on the daily time cards should be condensed and distributed on weekly time cards, like that in Fig. 2, by the timekeeper in the office every day, and at the end of the week again condensed from the weekly time cards and distributed on the weekly pay roll and time distribution sheet which is shown in Fig. 3. Upon examination, it will be seen that the keeping of time in this manner involves no extra work. If no such cards or sheets were provided, it would be necessary to do the identical work for which they are provided upon blank sheets of paper and the results recorded on slips or in books. Keeping track of the time and expenses in this manner results

in collecting all the time and expenses spent by a man upon a given order during the week, and giving it in a single figure in the totals column of sheet, Fig. 2. Sheet Fig. 3 still further condenses by giving in its totals column the time and expenses spent by all employees on any given job during the week.

J. CORNIZE & CO., NEW YORK

WEEKLY TIME CARD

Name John Brown Week Ending Dec 19 1910

Job Numbers	464		740		846		942										Totals	
Sunday																		
Monday	1	80		80													2	60
Tuesday		60			1	40		40									2	40
Wednesday	1	40			1	00											2	40
Thursday			2	40													2	40
Friday			1	00		60	1	00									2	60
Saturday	2	40															2	40
Totals	6	20	4	20	3	00	1	40									$14	80

Fig. 2. Actual Size of Card, 4 × 6 Inches

In passing, attention is called to the "Change Table" on sheet, Fig. 3, which gives the exact number of bills and coins of different denominations required to make up the pay roll.

Owing to limited space, Figs. 2 and 3 are not shown with as many divisions as may be necessary for use in practice, but it will, of course, be understood that the number of divisions can be regulated to suit the number of orders likely to be received and the probable number of men employed in the busiest season.

Fig. 4 is a receipt blank printed upon the back of the weekly time card. Thus, when signed by the employee upon receipt of wages, the weekly time card constitutes a complete record for that particular employee's time and expenses for that week.

To illustrate in detail how sheets, Figs. 1 to 3 inclusive, are used, assume that John Brown has filled out his daily time card, as shown, dated December 14, which was Monday. This data will be seen on the weekly time card opposite Monday and under the job numbers shown on the daily time card. Imagine that John Brown has turned in his time cards for the balance of the work, having spent Tuesday on jobs 464, 846 and 942; Wednesday, on jobs 464 and 846; Thursday, on job 740; Friday, on jobs 740, 846 and 942, and Saturday, on job 464, all as indicated by the amounts placed under the above numbers opposite the proper day on sheet, Fig. 2. On his weekly time card the total week's pay amounts to $14.80, distributed as follows: On jobs 464, $6.20; 740, $4.20; 846, $3, and 942, $1.40, all as shown in the totals columns of Fig. 2. These totals are then transferred to the weekly pay roll and time distribution sheet, Fig. 3, as shown.

In order to illustrate more fully the use of the latter sheet, assume that Tom Smith, Sam Jones and Bill Smith have also filled out daily time cards, which have been transferred to the weekly time cards and thence to the pay roll under the job numbers indicated, in the same manner as John Brown's time has been taken care

of. Thus, the week's pay of all the workmen mentioned appears in the "week's pay" column, and opposite each amount in the "change table" the denominations and number of bills and coins needed to make up the respective amounts are shown. The total week's pay roll as shown is $53.88, and requires 4 10-dollar

J. CORNIZE & CO., NEW YORK.

WEEKLY PAY ROLL & TIME DISTRIBUTION SHEET

Week Ending Dec. 19 1911

NAMES	JOB NUMBERS 464	740	846	942	560	320	482	653	745	WEEKS PAY	CHANGE TABLE 20	10	5	2	1	.50	.25	.10	.05	.01
John Brown	6 20	4 20	3 00	1 42						14 80		1		2		1	1		1	
Tom Smith	8 00		3 20		2 00	1 00				14 20		1		2				2		
Sam Jones		2 30		6 40			2 10	1 60		12 40		1		1			1	1	1	
Bill Smith	4 00		6 00		1 10	92			46	12 48		1		1			1	2		3
TOTALS	18 20	6 50	12 20	7 82	3 10	1 92	2 10	1 60	46	$53 88		4		6		1	3	5	2	3

Fig. 3. Size of Card or Sheet Depends on Extent of Business Conducted.

bills, 6 2-dollar, 1 50-cent piece, 3 25-cent pieces, 5 10-cent pieces, 2 5-cent pieces, and 3 1-cent pieces, to make up the total amount in separate pay envelopes. The amount of time spent by all the workmen on the respective jobs is shown in totals columns of the weekly pay roll sheet. The method of further taking care of these totals will be considered later.

For the purpose of getting at the labor cost, not only of the different kinds of work included in an order, but of the different parts of each kind of work, the Labor and Expense Cost Sheet, Fig. 5, is provided. The data given on the daily time cards are condensed and distributed on this sheet. To keep track of the material, the Material Cost Sheet,

New York, Dec 19 1911

Received of J.CORNIZE & CO.

Fourteen and 80/100 Dollars

For Wages and Expenses in full to date.

Name John Brown

$14 80/100

Fig. 4. Actual Size of Card. 3½×6 Inches

Fig. 6, is provided, a supply of which should be kept out in the shop by the foreman, upon which to record weights or quantities of material used. The total costs of both labor and material are condensed and distributed on the Total Cost Sheet, Fig.7, as indicated.

The advantage realized in keeping all the data concerning the cost of the work on separate sheets instead of in books is that if the order is a small one a single sheet is all that is necessary, and if it is a large contract, as many sheets of Fig. 1 to 7, inclusive, as are necessary can be used and kept together, thus constituting a record that grows with or adapts itself to the requirements of the contract and gives the final result in concrete form on one single sheet of paper, Fig. 7, regardless of the size of the order or the length of time required to fill it. Moreover, no work is required other than what would be absolutely necessary to do the work in any event, the difference being that the figuring that must be done in any case is done upon the printed forms and preserved, thus, in fact, saving instead of making work, as copying off into books or on other forms is obviated.

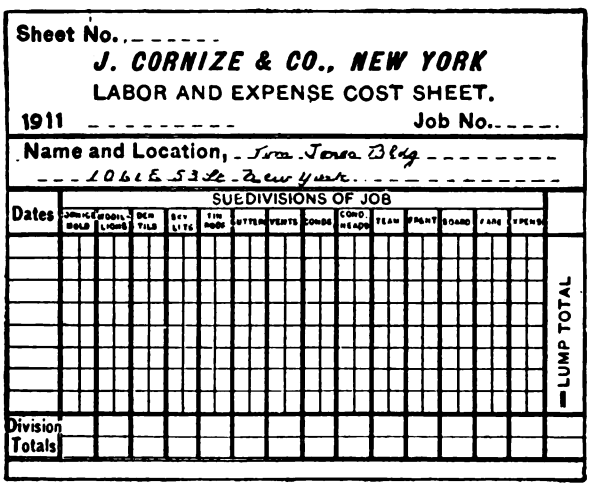


Fig. 5. Actual Size of Card, 5×8½ Inches

The proper percentage of general expenses or fixed charges, must of course, be added to the cost of material, labor and incidental expenses in order to arrive at the true cost of a job. Among the many advantages of this system is that of showing the cost of a job to date at any time; provided, of course, the entries have been made regularly.

A somewhat more detailed description of the method of using the sheets, Figs. 5, 6 and 7, may be helpful. The Labor and Expense Cost Sheet, Fig. 5, is filled in with the amounts taken from the daily time cards. It will be noticed that the totals column of the sheet, Fig. 5, runs across the bottom of the

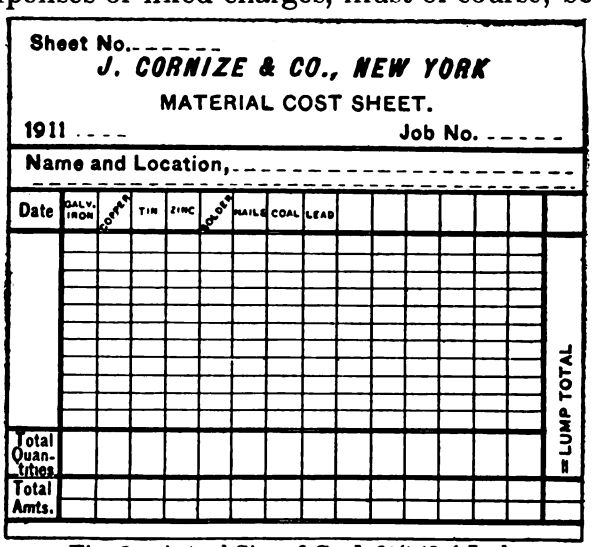
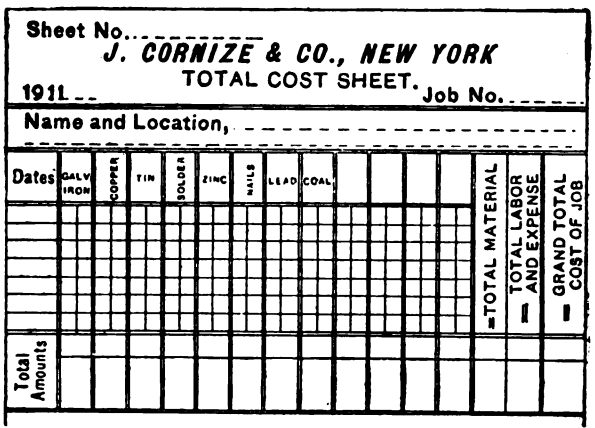


Fig. 6. Actual Size of Card, 6½×8½ Inches

sheet, thus placing the totals figures at right angles to the items figures; but this will not be found inconvenient in practice.

The Material Cost Sheet, Fig. 6, is filled in by the foreman as the manufactured material is sent out. The number of pounds or other quantities are filled in under the proper headings and the totals converted into amounts of money and inserted in the "Total Amounts" column, running across the bottom of the sheet. While the material should be filled in by the foreman, the money amounts should be figured up in the office.


Sheet No._____

J. CORNIZE & CO., NEW YORK

TOTAL COST SHEET.

1911 __ Job No. _____

Name and Location, _____

Dates	GALV. IRON	COPPER	TIN	SOLDER	ZINC	NAILS	LEAD	COAL					= TOTAL MATERIAL	= TOTAL LABOR AND EXPENSE	= GRAND TOTAL COST OF JOB
Total Amounts															

Fig. 7. Actual Size of Card, 5×8½ Inches

The Total Cost Sheet, Fig. 7, is filled in with the lump totals from the sheets, Figs. 5 and 6. The "Total Amounts" column of this sheet also runs across the bottom of the page.

It will be seen that if all the sheets are kept filled in as the work progresses the accumulated cost is shown at all times. A number of date lines are provided on the sheet, Fig. 7, so that the cost can be thus figured up at different times. It will be understood, of course, that if the number of date lines provided are not sufficient the totals can be transferred to a second sheet, or as many more sheets as are necessary, the last sheet giving the grand total.

INITIAL EQUIPMENT FOR SHOP

The tools required for a sheet metal cornice shop would be as follows: Cornice brake, 8 feet long; small brake, 3 feet long; brace bender, brace cutter and puncher, square head, hatchet stake, mandrel stake, blow horn stake, squaring shears, 30-inch or 36-inch; pipe roller, 36-inch length; vise, round headed stake, small turning machine, raising and stretching hammers of various sizes, block for raising, made of lead 12×12×3 inches; various sizes of hollow punches, and if large work is undertaken in circular work a curved molding machine, and beading machine for beading eave troughs. The tools required for a tin shop doing tin roofing, etc., would be a tin notcher, edger for flat seam roofing, edger for standing seam roofing, hand seamers, and for tin shop work a groover, crimper and swedging machines, hand groovers, soldering coppers, file, mallet, prick punches, rivet

punches, rivet sets, scratchawls, compass, plyers, scraper, chisel, hammers, right and left and circular shears and stock shears.

For laying out details for cornice work there would be required one drawing board, about 4×6 feet; one small board, 2×3 feet, T squares to match; triangles of 33, 45 and 60 degrees, No. 4 pencils and set of drawing instruments. Other tools may be required according to the nature of the work in hand, but these can be obtained when wanted.

HINTS FOR SHOP ARRANGEMENT

The importance of shop arrangement is not generally appreciated. The location and position of machines, benches, etc., is too often governed by the disposition of existing shafting, the size of machines, the unoccupied space available, etc., rather than by the natural course through the shop which the material should take in its manufacture. It is poor economy to set a machine convenient to existing shafting because the shafting is convenient, rather than to set it where it would be much handier for the work and to change the shafting accordingly.

The fundamental principal which should govern the arrangement of equipment is that all facilities should be so disposed that no handling of the material should be required except what is necessary in actual working. It is easier to handle sheet metal in the form of bundles or whole sheets than after it is cut. Therefore, the shop should be so arranged that the manufacturing process begins adjacent to the racks and proceeds, step by step, until finished, which should be near the exit. In other words, when one man has finished his part of the process it should be convenient for him to place the material just where it is needed by the next man, thus passing the work from man to man without requiring any special trucking or moving.

The condition or disposition of floor space often precludes the arrangement of all equipment in accordance with this theory, but the system can always be adhered to, more or less. To illustrate, assume the existence of a shop about 50×100 feet, and proceed to place ordinary cornice equipment therein, as shown in Fig. 8. As this deals with the shop arrangement only, the office space, stock rooms, or yard, will not be considered further than that the door *a* leads to the office and stock room, and door A to either the street or lot. The idea is to get the material into the shop and have it passed around through the different processes of manufacture and out again without crossing its track.

Therefore, locate the equipment as follows: No. 1, 6×12 foot counterbalanced upright drawing board; No. 2, 5×8 foot horizontal drawing board, with a tier of large drawers underneath; No. 3, material racks; No. 4, crimper bench; No. 5, crimper; No. 6, crimper bench; No. 7, 10-foot shear; No. 8, principal cutting bench; No. 9, 36-inch square shear; No. 10, auxiliary cutting bench; No. 11, 36-inch square shear; No. 12, miter cutting machine; No. 13, bench to receive

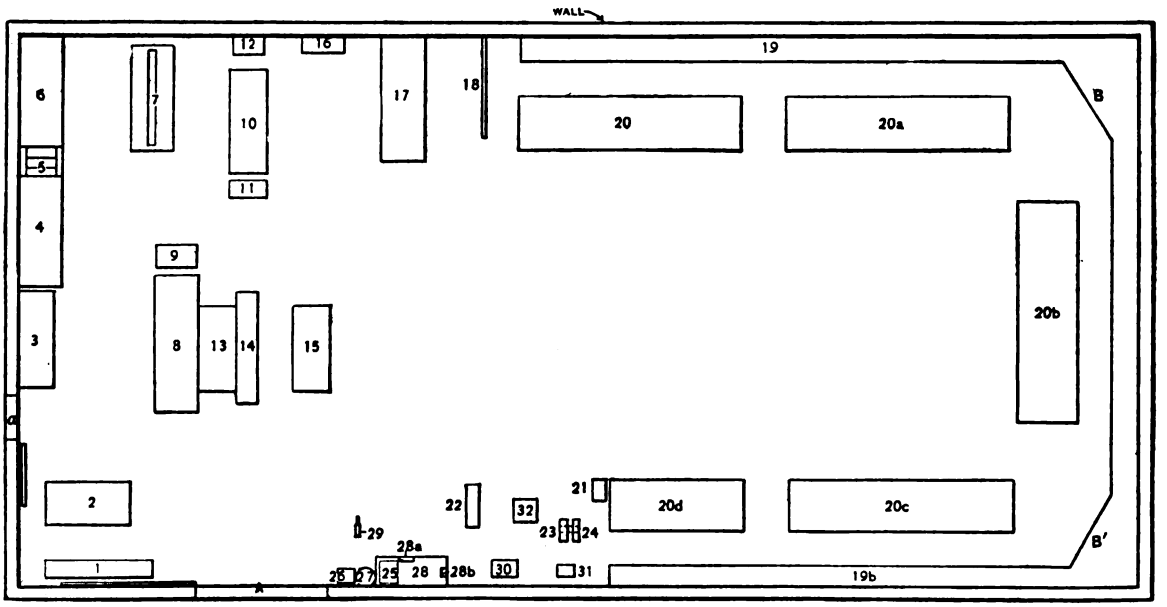


Fig. 8. Hints for Shop Arrangement

material as it is cut, ready for forming; No. 14, large hand brake; No. 15, revolving bench in front of brake; No. 16, small hand brake; No. 17, bench for small tools, stakes, burring machines and rolls; No. 18, pipe grooving mandrel; No. 19, 19a, 19b, a narrow bench next the wall, upon which the fire pots are located, hand tools laid and small work assembled; No. 20, 20a, 20b, 20c, assembling benches; 20d, model and circular work bench; B and B′, corner benches, made by increasing the width of bench No. 19, on which small work can be put together; No. 21, drill; No. 22, punch and shear; No. 23, emery wheel; No. 24, grindstone; No. 25, coal bin; No. 26, forge; No. 27, slack tub; No. 28, bench; No. 28a, vise; No. 28b, brace bender; No. 29, anvil; No. 30, large drop press; No. 31, small drop press; No. 32, band saw.

Racks for bar iron can be arranged on the wall over bench 19b. In addition to rack 3, racks can be arranged under benches 4, 6, 8, 10 and 13, for different sizes and gauges of sheet iron and copper.

It will be seen that the drawing boards or the foreman's headquarters are located convenient to the entrances and adjacent to the cutting and bending

department, that the material racks are also convenient to the doors, and that the completion of each process in the manufacture leaves the material where it is needed for the next stage. In verification, assume that the racks have been filled and cornice job started. The first step is taking the proper material from the rack and placing it on bench 4, from which it is run through the crimper 5, on to bench 6, then split on shear 7, cut on bench 8 and left on bench 13, which should be made higher than bench 8, so that the material can be reached over the top of brake 14. Most of the small work, skylight bars, or other stock work admitting of the use of a machine miter cutter, can be cut on bench 10, the short work being formed on the small brake 16. It will be seen that the stakes and rolls are convenient to the small brake, which facilitates forming. Thus, the completely formed work is naturally left somewhere near the end of the bench 20, where, as also upon benches 20a to 20c, inclusive, the assembling is done, thus leaving the finished product somewhere about the middle of the shop, or near the exit door A.

It will be noticed that the forging, wrought iron and stamped work are also done near the foreman's headquarters, thus placing all the preliminary stages of construction convenient to his oversight.

If the different parts of cornice work are properly gotten out and formed, the assembling is a comparatively simple matter and does not require as much of the foreman's attention as the preliminary stages, although he must see that the work is properly put together.

The forge, anvil, punch and shear, drill and emery wheel should be so placed that long bars can be welded together or worked. For instance, if the anvil is placed where it is obstructed by benches or machines it would be impossible to weld two long bars together. In case it should be necessary to punch holes in the central portion of a long bar of iron, it could not be done, if the punch was placed close to any obstruction on either side.

Cutting benches 8 and 10 should be about 4×12 feet; revolving bench No. 15, 3 feet wide by 8 feet 6 inches long, and bench No. 17, 4 feet wide. Assembling benches 20 to 20c, inclusive, should be 5 feet wide, so that, for ordinary work, both sides can be used at the same time by different men, and ample surface be provided for large work. Bench 19 to 19b need not be more than 20 inches wide.

If an upright power brake is used, instead of a hand brake, the relative positions of the cutting bench 8 and the brake would be changed.

In addition to the placing of equipment so that the material will naturally pass from one process to another without special handling, the center of the shop should be kept as clear as possible, all benches being parallel with and as near to

the walls as they can be brought, unless the shop is large, in which case the benches should set at right angles to the wall. The necessity for leaving clear floor space is repeatedly recurring, and aside from this, the handling of the work and passing to and fro are greatly facilitated by leaving the center portion of the shop as free of obstruction as possible.

It is not supposed that the equipment above enumerated covers all the facilities used in all shops. The principal tools and machines are used merely to illustrate the system of arrangement presented.

KEEPING TRACK OF DRAWINGS

One of the perpetual annoyances in most shops is the inability to lay hands on drawings when they are wanted, without losing time and patience in rummaging among drawers or racks and unrolling a number of sheets before finding what is wanted. This is especially so when drawings of a completed job are wanted.

NO. OF TUBE	DRAWER	JOB NUMBER	1911 DATE	NAME AND LOCATION OF JOB	REMARKS
40	C	1849	3/10	*John. Jones. Bldg. Providence. R.I.*	
	E	1968	4/18	*Wm. Smith House Pawtucket " "*	

Fig. 9. Leaf of Blank Book

Herewith is presented a system or method of keeping drawings which was found to work perfectly and which calls for very little extra attention.

The system requires a blank book, ruled as shown in Fig. 9, a set of drawers or racks, indicated by letters, and a tube rack with tubes consecutively numbered, as indicated by Figs. 10 and 11, which show front and sectional views respectively of the tube rack. Upon receipt or completion of a drawing, sketch or data of any kind descriptive of the work, it should at once be marked with the name, number and location of the job and the letter on the preliminary drawer or rack in which it is to be kept handy—near the drawing board—until the job is completed, after which it should be marked with the number of the tube in rack, Fig. 10, and in which it should be then stored.

The blank book, Fig. 9, should be of ample size and spaces should be ruled for inserting the tube number, drawer or rack letter, job number, name and location of job, remarks, etc., and the date of receipt of the shop order should be entered when the same is marked on the drawing. The number of the tube in which the drawing is to be permanently stored after it is done with cannot be marked upon the drawing or entered in the book until the time arrives to store the drawing, when it should, of course, be marked on both. The space for remarks is provided in which to record when and by whom any drawing is taken out of the shop or returned. The book should be provided with an index, and the jobs should be entered therein by name in alphabetical order.

While the preliminary set of lettered drawers or racks should, of course, be handy for immediate reference while the work is under way, the rack for the numbered storage tubes can be located in any out of the way place, as it will be comparatively seldom referred to.

The tubes can be provided as needed and can be made with bottoms and

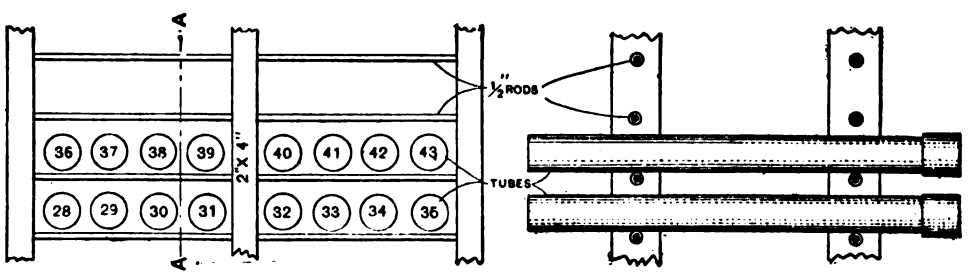


Fig. 10 Tin Tubes and Rack Fig. 11

removable tops, so as to protect the drawing from dust, or they can be left with open ends, which will answer the purpose very well. They can be of different lengths and diameters, and drawings of different jobs can be stored in the same tube. The cheapest way to make the tubes is to use stock conductor pipe. A good tube rack is made with 2×4 inch scantling uprights, bored to receive ½-inch iron rods for carrying the tubes, as indicated in Figs. 10 and 11.

If care is taken to make the entries in the book so that the job numbers run consecutively, and to see that the name is also entered in the index in proper alphabetical order, there will be no trouble in locating any drawing at any time, no matter how long after the job has been finished. If the name of the job is the only clue in hand, it is easily found in the index, which refers to the page of the entry which gives the job number and the drawer letter and the tube number. If no tube number is given, the drawing will, of course, be found in the drawer indicated by the letter, but if a tube number is given it shows that the drawing has been taken

from the preliminary drawer or rack and deposited in the tube rack. If the job number is the only clue at hand, it is only necessary to glance along the consecutively entered job numbers until the required number is reached, which is, of course, a part of the entry showing where the drawing is stored.

This system, like any other, to be of any use must be rigidly and unvaryingly observed. Any one who uses drawings will be repaid many fold by its use.

DETAILS OF UPRIGHT DRAWING BOARDS—I

One of the most important articles of equipment in the cornice shop is the drawing board. In a few large shops large horizontal boards can be used without

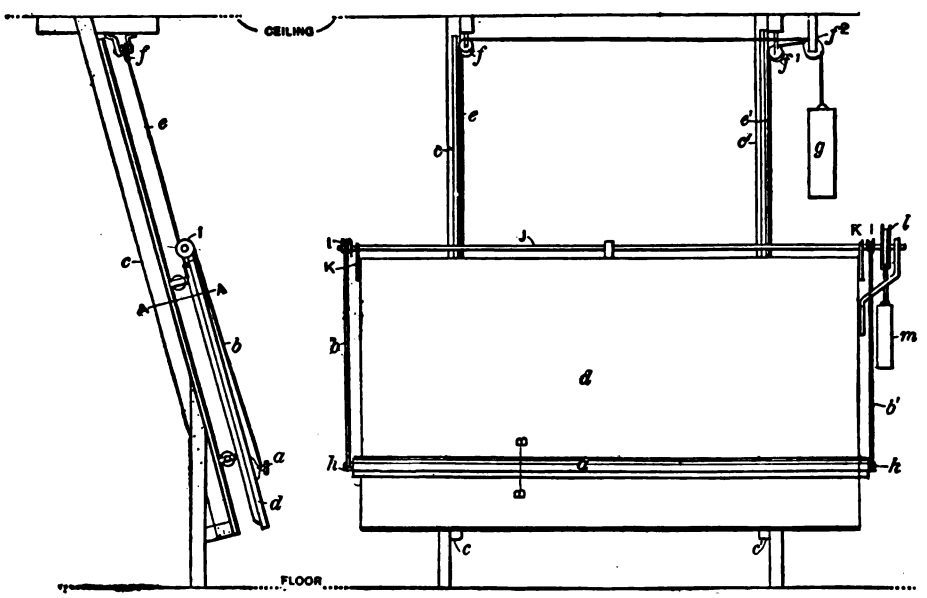


Fig. 18. Side and Front Elevation of Board Fig. 12

inconvenience as to the space occupied, but in the great majority of shops the necessary space for a large board can ill be spared. But, aside from considerations of floor area, the upright drawing board has many advantages over the horizontal board for large work, the chief of which is that all parts of the board's surface are easily accessible, without the necessity of stooping or reaching. Large work can also be viewed more comprehensively on an upright surface than is possible on a horizontal table. In the former case the operator is, in effect, directly over or in front of the work, instead of at a low angle with the surface viewed, as in the latter case, and is, therefore, better able to judge proportions, dimensions, etc. It is also less fatiguing to work at an upright board, for the reason that the body is always

erect, with lungs expanded, whereas work on a horizontal table necessitates a more or less bent position, with contraction of the lungs.

Vertical drawing boards are not necessarily difficult of construction or operation. Like almost everything else, they can be made good, bad or indifferent. The illustrations show what the writer considers to be a first-class board of its kind. A front view is given in Fig. 12, and in Fig. 13 a side view; a detail of the rollers and track upon which the board travels up and down in Fig. 14; in Fig. 15 a section of the longitudinal rule, or straight edge, *a*, and in Fig. 16 views of the rollers from which the rule *a* is suspended by means of the steel or brass tape *b*. The uprights *c* and c^1 extend at a slight angle from the floor to the ceiling, the end at the floor terminating in a figure 4 brace, as shown, in order to provide clear foot room for the operator in front of the board. The board *d* is guided on the upright members *c*, as shown, and is suspended by cables *e* and e^1, which pass over pulleys *f*, f^1 and f^2, both cables being attached to the single weight *g*, which should exactly balance the weight of the board and fittings attached thereto. The object of securing both cables to the same single counterweight is to insure the simultaneous and parallel movement of both ends of the board, regardless of the point at which the motive pressure is applied. The axis of pulleys *f* and f^1 should be about perpendicular to the surface of the board and the axis of f^2 exactly horizontal. The pulley f^2 is, of course, double, in order to accommodate both cables.

The rule *a*, Fig. 12, extends the entire length and projects over each end of the board. It is made of hard wood, and faced on edges with sheet brass, a^1, Fig. 14, on its upper edges. When attaching this brass edge the rule should be suspended from its ends, in the same position it will occupy when in use on the board, so that proper allowance can be made for sagging, leaving the brass edge perfectly straight. The pins *h* in the ends, by which the rule is suspended, should be located at the center of gravity of the rule.

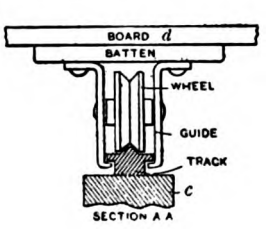


Fig. 14

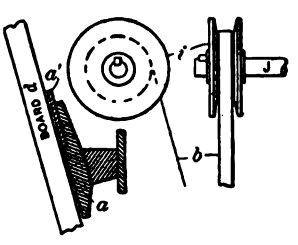


Fig. 15

Fig. 16

Details of Upright Drawing Boards

The metal tapes *b* and b^1 which sustain the rule *a* are wound on deep flanged pulleys *i* and i^1, carried on ½-inch pipe shaft *j*, which, in turn, is supported in bearings *k* secured to the upper edge of the board. Another pulley, *l*, is similar to but larger than the pulleys *i*, on which a metal tape is wound and attached to the counterweight *m* which balances rule *a*. It will be seen that the weight *m* with pulleys *i* and *l*, shaft *j*, tapes *b* and rule *a* is attached to and

carried up and down with the board. The reason for placing the weights at one end of the board is to have the space behind the board clear for racks in which to keep drawings handy.

In operation, the entire board d is raised or lowered from time to time to any position desired, and the rule a is raised or lowered on the face of the board, always remaining in a horizontal position, no matter at what point the operator places his hand to move it, because pulleys i and i^1, from which the rule is suspended, are of equal diameter and secured to the same shaft.

The tee squares used should have the top surface of their blades let in flush with the top surface of the butt, and the outer edge of the butt should be square or perpendicular to the edges of the blade, so that the square can be set on top of the wood edge of rule a and against the face of the brass edge a^1.

DETAILS OF UPRIGHT DRAWING BOARDS—II

There are several methods of accomplishing the moving up and down of the board and straight edge, and sometimes the necessary mechanism is placed at the back of the board. Whatever be the method employed it is evident both freedom and accuracy of movement of the straight edge must be insured in order that all lines drawn along its edge shall be exactly parallel. These results can perhaps be most perfectly and simply accomplished by the design shown in Fig. 17 of the accompanying illustrations, which will require very little explanation. A pair of bearings are screwed to the top edge of the board, through which passes a rod or piece of small shafting, running the entire length of the board and extending sufficiently beyond at each end to receive a pair of sprocket wheels. Chain belts are attached to each end of the movable straight edge and are passed over the sprocket wheels and attached to a pair of counterweights sufficiently heavy to balance the weight of the straight edge when at the position most used. As both sprockets are firmly keyed to the shaft, any movement at one end of straight edge insures an equal amount

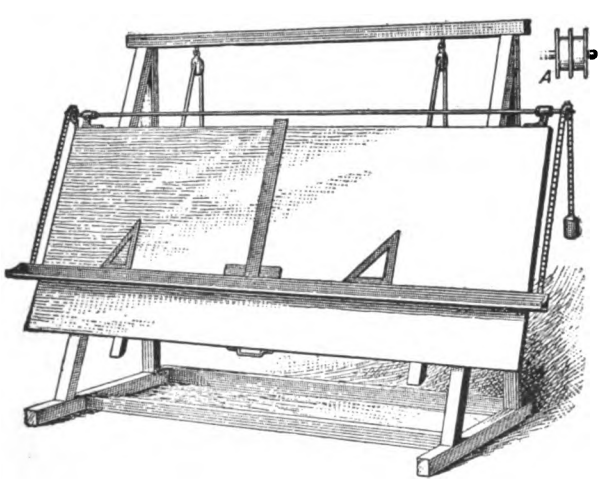


Fig. 17. General View of Upright Drawing Table, with Movable Straight Edge

of motion at the other. Sprocket wheels and chains of the type used on bicycles will be satisfactory for the purpose, though chains of light weight, if constructed without play, will perhaps be more desirable. A small clip or slide fixed to the projecting ends of the straight edge at the back and passing behind or under the edges of the board will prevent the straight edge from lifting away from the face of the board.

As in the upward movement of the straight edge the chain is being passed over the wheels, some weight is being constantly transferred from the near side to the further side of the wheels. This would have a tendency to prevent the straight edge remaining at rest when at any position other than that near which the counterweights have been adjusted. As it is usual to incline the board somewhat, as shown in the figure, this difficulty is in part overcome by friction. With this in view it is customary to sometimes attach a tray or projecting shelf to the straight edge, running its entire length, upon which drawing instruments, etc., may be laid. The difficulty may be entirely overcome, though at greater expense, by placing another shaft and sprockets against the lower edge of the board, and, discarding the counterweights, passing the chains around the lower pair of wheels back to the straight edge, where they may be attached in such a manner as to take up any slack.

Instead of the sprocket wheels, flanged drums, such as shown at A, may be substituted at the ends of the shafting, around which is wound metallic tape in place of the chains. For this purpose the tape must be in two pieces at each end of the board. The piece which is attached to the straight edge at its lower end must be firmly attached at its upper end into one channel of the drum, while the other piece of tape is similarly fixed at its upper end in the other channel of the drum, its lower end being attached to the counterweights. Thus as one piece of the tape at each end of the board is being wound up by the upward movement of the straight edge the other piece is being unwound by the counterweight, and both being attached to the drum, neither can slip.

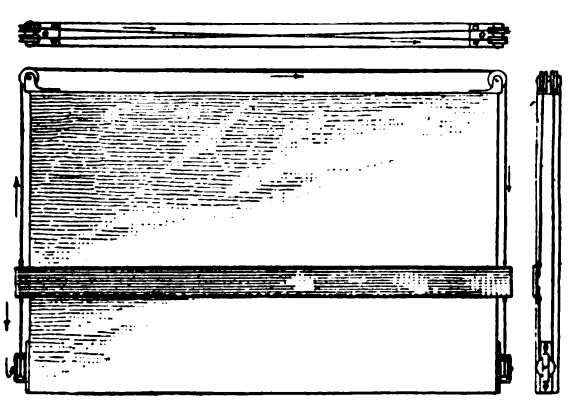


Fig. 18. Drawing Board, with Movable Straight Edge Operated by Means of Cords and Pulleys

The drawing board is usually suspended from the upper beam of the framework by means of ropes attached to it at the back, which pass over pulleys, as shown, to counterweights

behind. This permits the entire board with its attachments being raised or lowered at pleasure, the board being kept in a horizontal position by means of cleats on the back, which slide against the sides of the inclined beams.

The parallel movement of the straight edge may also be accomplished by means of cords passing around a system of pulleys attached at the corners of the board, as shown in Fig. 18. This method is adaptable to boards of smaller size and is more liable to error on account of the stretching of the cords. If, however, very fine woven cord and smoothly running pulleys be used, good results can be obtained. The cords are crossed at the top of the board, as shown in the top view. Thus the cord which is attached to the upper edge of the straight edge at the right end passes over the near pulley at the upper right hand corner of the board and over the further pulley at the upper left corner, and thence down and around the lower pulley at the left side, and is then fastened to the lower edge of the straight edge. If the direction of movement be followed along this cord, as indicated by the arrows, it will be seen that a downward movement of the straight edge at its right end will cause a movement in the same direction at the left. In the same manner an upward movement at the right would be transmitted to the opposite end through the other cord. The lower pulleys should be attached to the edges of the board by screws passing through slotted holes, so that any slack in the cords occasioned by usage can be taken up.

Other methods, such as a rack and pinion movement, also a pair of levers crossed and working between the lower edge of the straight edge and a projecting strip on the lower edge of the board, have been used.

DETAILS OF UPRIGHT DRAWING BOARDS—III

In the preceding articles, the methods of constructing upright drawing boards were described. The illustrations herewith show another and a cheaper construction, which will answer the purpose of such a board, but will, of course, work somewhat more stiffly and afford more opportunity for inaccuracy than the constructions first described. Boards of this construction are in use in many shops.

A back view of the complete board is given in Fig. 19, a side view in Fig. 20, and in Fig. 21, a detail showing how the board is connected with and guided on the inclined uprights without rollers. The board is suspended and counterbalanced in the same manner as those previously described, except that in place of the rollers, strips or stops are secured to the under surface of the board on each side of the inclined uprights for guiding the board in its up and down movement.

The rule A is attached to the members B and B^1 at each end of the board. To the upper end of B the fine steel wire or cable C is attached and passes up and over pulley D on the back of the board, thence diagonally down and under the pulley E, and thence up to the lower end of B^1, where it is secured. Another similar wire, F, is secured to the upper end of B^1 and passes up over the pulley G, and thence diagonally down across the wire C and under the pulley H and thence up to the lower end of B, where it is secured. The wires should lie as close to the back surface of the board as possible, the battens on the back of the board being notched out, or bored, to allow the passage of the wires.

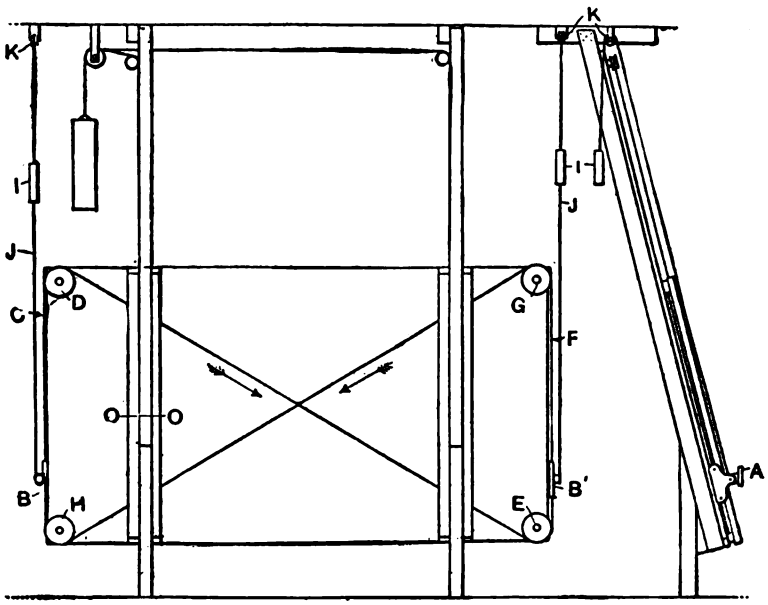


Fig. 19 Back and Side Elevation of Board Fig. 20

It will be seen that the suspension of rule A in this manner also keeps it in a horizontal position at any point on the board. For instance, if the rule is grasped at the end nearest B and moved upward, the wire C is slackened and the wire F tightened, so that the end nearest B^1 is also drawn up to the same extent, and vice versa. In other words, any vertical movement of either end of rule A is directly and exactly transferred to the other end by means of the wires C and F. The weight of rule A is sustained or counterbalanced by the weights I, which are connected with the rule by the cord J passing over the pulleys K.

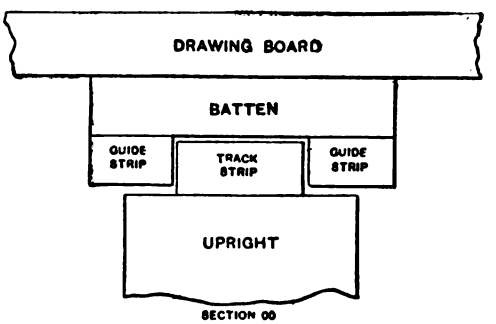


Fig. 21. Guide Track

The comparative disadvantage of controlling the rule A in this manner is that its movement near the lower and upper edges of the board is limited and it cannot be raised away from the surface of the board except just far enough to insert paper under it easily. While, theoretically, the rule is liable to get out of a horizontal position by the slackening of one of the wires, it has been found fairly reliable in practice.

DESIGN FOR DRAWING TABLE

In the preceding articles there were shown details of the conventional upright board that is practically essential in a well-ordered establishment. Following this article on a table, there is presented details of a horizontal board or table, which even if an upright board is in possession, would be required, although one not so elaborate would suffice. That is, an ordinary board supported on two common carpenter horses, this board to be of a size commensurate with the needs of the class of work done.

Fig. 22. General View of Table

The adjustable table, details of which are herewith presented, is more suited for home work and is made as follows:

The frame of the table is designed to hold a 36×60 inch board and to be used with the board as a table when working with smaller boards. A general view of the table is shown in Fig. 22 of the sketches,

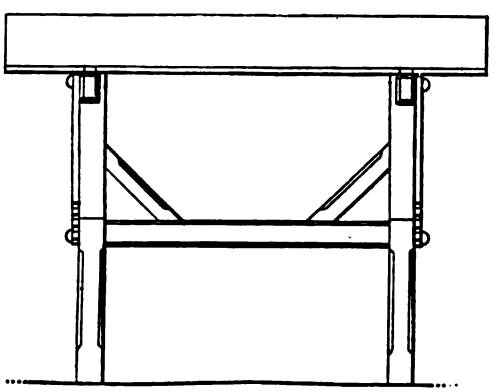


Fig. 23. Front Elevation

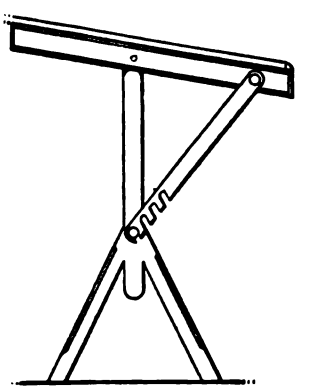
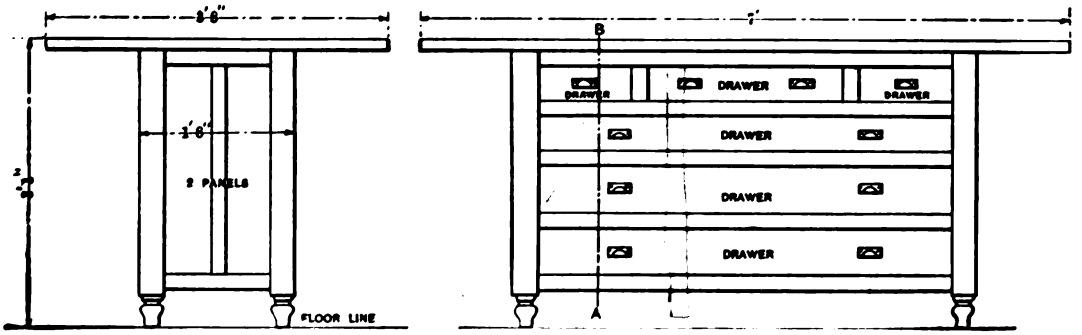
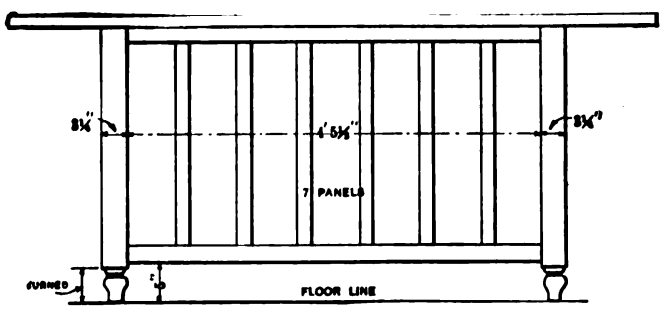


Fig. 24. End Elevation

while Fig. 23 represents a front elevation and Fig. 24 an end elevation. From an inspection of the latter it will be seen that the top may be adjusted to stand at any desired angle. The principal parts of the frame are 2×3 inch poplar, stained and finished to represent black walnut. A smaller board as a top and lighter material for the frame could be used if preferred.

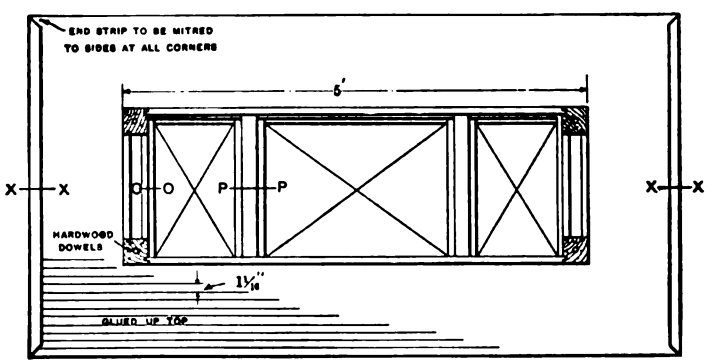


End and Front Elevations of Drafting Table. Scale, ½ Inch to the Foot

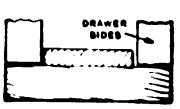


Rear Elevation of Table

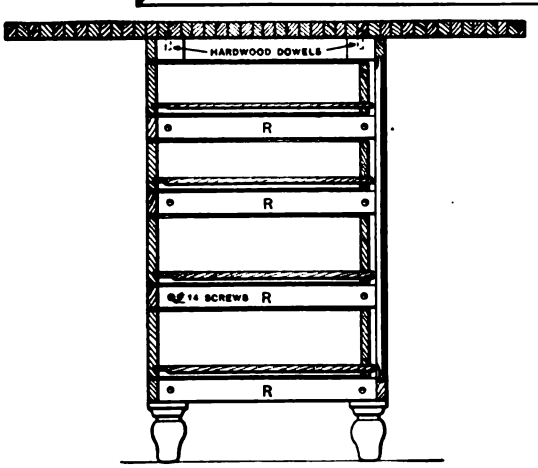
Plan of Table Top and Horizontal Section at Top of Cabinet.
Scale, ½ Inch to the Foot



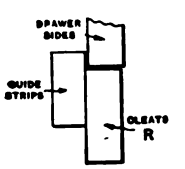
Section on Line X-X.
Scale, 3 Inches to the Foot



Section of Drawer Slides of Line P-P of Plan. Scale, 3 Inches to the Foot



Vertical Section Through Table Taken on Line A-B of the Front Elevation. Scale, ½ Inch to the Foot



Section of Drawer Slides on Line O-O of Plan.
Scale, 3 Inches to to the Foot

Fig. 25. Details of a Drawing Table and Cabinet

DETAILS OF A DRAFTSMAN'S TABLE AND CABINET

The drawing table which is shown somewhat in detail by the illustrations, Fig. 25, is a style which has been found very satisfactory in every way. It is of such a nature as to meet all requirements. It is believed that the illustrations are sufficiently clear to need no extended description of this table.

REVOLVING WORK BENCH

A most useful bench in the manufacture of various sheet metal products is one that revolves. A saving of considerable of the workman's time is thereby effected owing to there being no need for him to walk around the bench when he assembles the many parts of the article of sheet metal. Although some men may prefer a bench of four straight sides, it does seem that one which is entirely circular, would not have corners to strike the man while revolving.

A decidely serviceable bench as shown by Fig. 26 can be made in this manner: First take 4×4-inch timbers 30 inches long for legs, four in number, and build with white pine 1 inch thick a circle 4 inches wide. Make this circle track 3 inches thick, mismatching grain of lumber, and fasten together with wrought nails or bolts. Cross two pieces through the center in such a way as to support a bolt in the center. The center can be made by taking a 1-inch nipple with long tread and using lock nuts above and below. This track should be 6 feet on the inside diameter and have 5 or 6 wheels 5 inches in diameter, 1 inch thick, set in this track by cutting holes through to receive the wheels; they can be on ½-inch rods and held in place by staples driven in the track over the rods. The legs should be braced from one to the other.

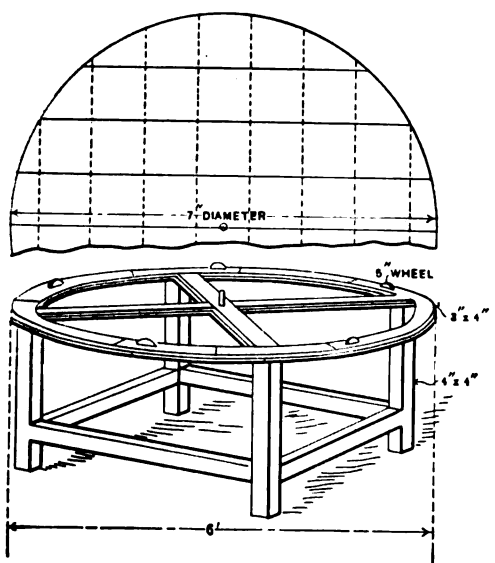


Fig. 26. Revolving Work Bench

The top is made 2 inches thick by crossing the boards and nailing through. It should be 7 feet in diameter, with a hole at the center to drop over bolt at the center of the frame. It turns very easily if all the bearings are made loose and kept well oiled. It would save the bench from wearing by nailing to its underside, a track of heavy

sheet iron, placed so as to come directly on the path of the wheels. Also on the underside of the bench top, holes should be drilled of a depth of, say, the first layer of boards and on a line with the circular supports of the wheels. These holes can be protected by pieces of heavy sheet metal that have a hole of the same diameter. The holes are to be spaced at suitable intervals, allowing the locking of the bench in any position desired by means of a spring bolt fastened to the circular track support. It would be an excellent idea to bore four holes in the top of the bench and close to the edge. The intention being, that these holes shall indicate the largest square that can be inscribed on this bench and by drawing diagonals from each, a means is obtained for nailing corner guide plates for assembling a number of square pieces of the same size.

DETAILS OF ASSEMBLING BENCHES

The part played by good benches in the execution of cornice work is not generally appreciated. In sectioning cornice moldings, gutters, etc., together, a good bench is essential, if the work is to be made straight and true. In order to insure accurate and durable benches care must be taken in their construction. It is well known that wood will swell, shrink and warp, unless precaution is taken to prevent or minimize these results. It is next to impossible to use wide boards in benches, floors, sheathing, etc., without having them warp and curl up at the edges. Therefore, when true surfaces are needed thoroughly dried narrow boards

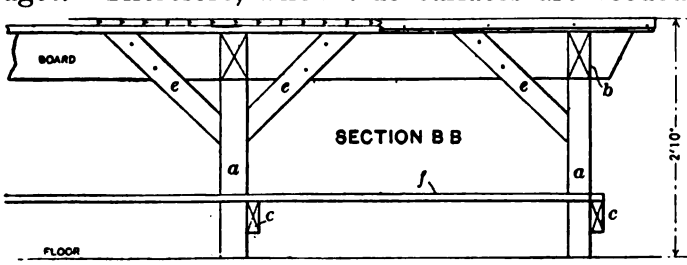


Fig. 28. Front Elevation

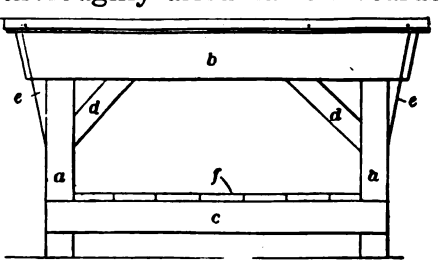


Fig. 29. Side Elevation

must be used, and so laid and secured that the extent to which warping occurs will not materially injure the surface.

Figs. 27 to 30, inclusive, illustrate one method of constructing assembling benches for cornice work, which has been proved to be satisfactory, the benches withstanding varying temperatures and degrees of humidity for years without warping. Fig. 27 is a plan looking down on top of the bench; Fig. 28, a side elevation; Fig. 29, an end view, and Fig. 30, an enlarged section on line A A of Fig. 27. The legs *a* are 3×4 inches, the beams *b* 3×6 inches, the cross pieces *c* 2×4 inches, and the braces *d* made of 3×3 inch stuff. The legs *a* are tenoned

into mortises in the ends of the beam *b*, the braces *d* are lag-screwed to the legs *a*, and the beam *b* and the cross bars *c* bolted to the legs *a*; the braces *e* are 2×4 inches. The bench should be 5 feet wide and 2 feet 10 inches high to the finished top.

The covering for the bench consists of a primary sheathing of 1¼×6 inch boards nailed to the beams *b*, the legs being spaced not more than 4 feet apart. A top finishing course of 2×⅞ inch matched boarding is laid on the 1¼-inch boards, the matched boarding being laid diagonally, as shown. All of the boarding

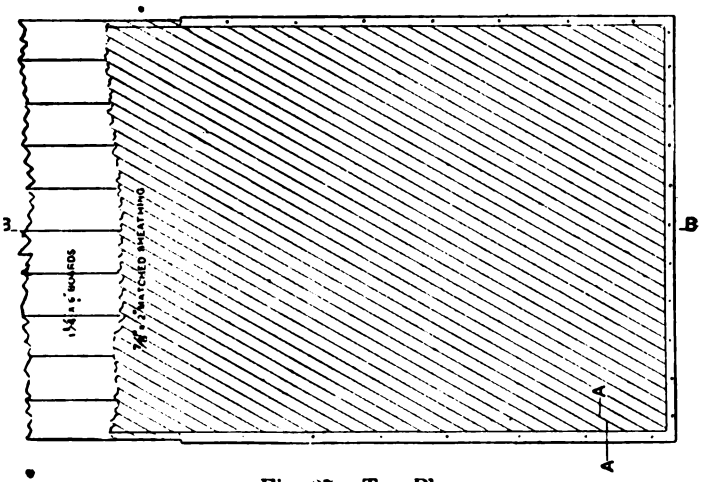
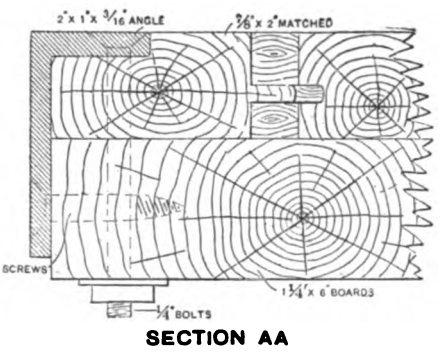


Fig. 27. Top Plan



SECTION AA

Fig. 30. Section Showing Guard

should be planed on both sides, as well as the top surface of the beams *b*. The bench should be bound on all four sides with 2×1×3 16-inch angle iron, secured by countersunk head bolts and screws, as shown. The angle iron should be let into the matched boarding so that the top of the angle and boarding will be flush. Care should be taken that the bench sets level. If the floor should not be true, wedges should be inserted under the proper legs in order to support the bench in a perfectly true plane.

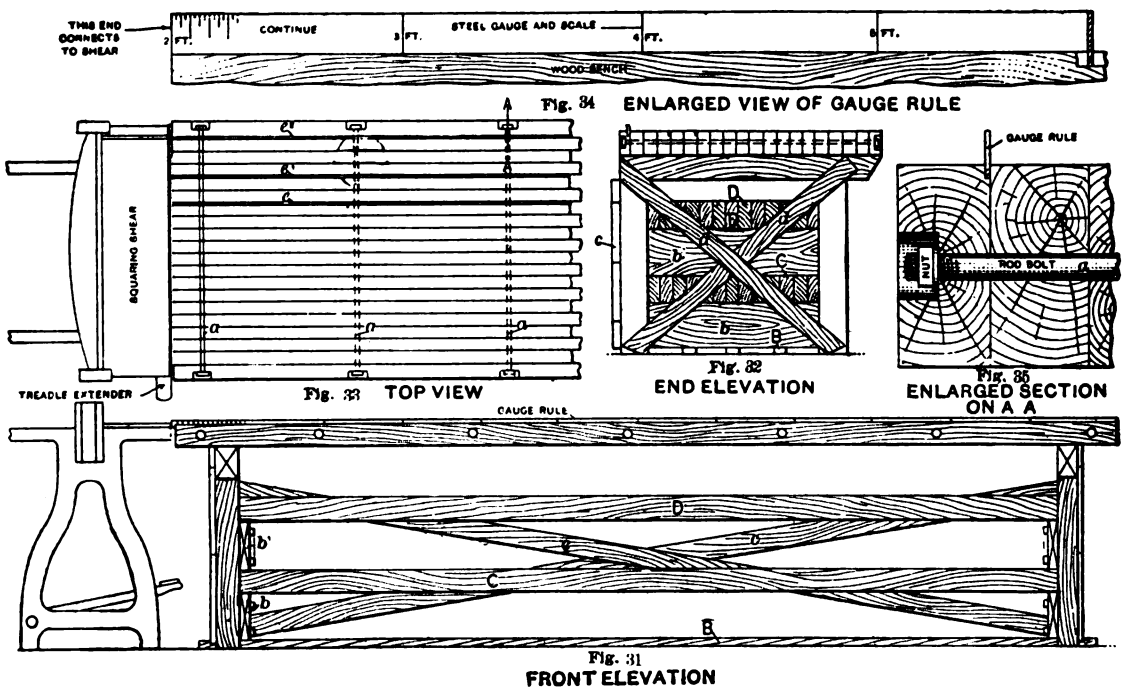
The shelf *f* of 1-inch boards laid on the cross bars *c* will be found very convenient upon which to lay tools and various things.

DETAILS OF A CUTTING BENCH

The cutting or getting out of cornice moldings, gutters, etc., is materially affected by the construction and arrangement of the bench used, both as to the quality and the quantity of the work turned out. All other things being equal, a man can turn out much more work from the bench described and illustrated herewith than from an ordinary unimproved bench.

If a stock of the sizes of iron most used can be stored directly under the cutter's bench much time will be saved in the handling of material. If crimped iron is generally used, the material can first be run through the crimper by the boys or helpers and then stored under the cutting benches. An improved bench is illustrated herewith, Fig. 31 being a front elevation, Fig. 32 an end elevation, Fig. 33 a plan, Fig. 34 an enlarged view of the measuring and squaring gauge, and Fig. 35 an enlarged section on line A A of Fig. 33.

For a cutting bench a smooth, even surface is very important, and when material is to be stored underneath the supporting legs are necessarily placed so far



Details of a Cutting Bench

apart that the construction previously described as suitable for assembling benches supported on legs not over 4 feet apart is not sufficiently rigid; therefore a different construction is necessary.

The one shown herewith has proved satisfactory. It consists of 2×4-inch dressed scantling, bolted together by the rod bolts *a*, with the wide faces in contact, as shown, making, when completed, a continuous surface about 38 inches wide by 4 inches thick and 12 feet long. The two legs can be constructed as previously described and should be placed 10 feet 6 inches apart. A topping thus constructed, with the bolts *a* spaced not more than 30 inches apart, and passing

entirely through all of the component timbers, will span the distance between the legs without sagging under the heaviest work.

The material racks B, C and D are constructed and arranged as follows: B is made of 1-inch strips, laid on the floor in order to prevent the iron from lying directly on the floor. Racks C and D consist of 2×4-inch rough scantling set up edgeways and supported on cross pieces b and b^1 which extend across the bench and are bolted to the inside faces of the legs. The bottom cross piece b rests directly on the strips on the floor; the rack beams C rest on the cross piece b; the cross piece b^1 rests on the rack beams C, and the rack beams D rest on the cross piece b^1. Thus the entire weight of the racks and their contents rests upon the floor and is not carried by the bench legs.

The longitudinal braces c, Fig. 31, and the end braces d, Fig. 32, are necessary to hold the bench rigid. In the top surface of the bench, grooves e, e^1 and e^2 are cut the full length of the bench. These grooves should be about ½ inch deep and just wide enough to fit a 10-foot steel rule, described later. A 36-inch square shear should be placed at the left hand end of the bench and firmly secured thereto, with the blade of the shear at right angles to the grooves e, the furthest side of the cutting blade of the square shear being in line with groove e^2.

The 10-foot steel rule above referred to can be bought already graduated into feet, inches and fractions of an inch. It should be about 1×¼ inch in section. Most square shears have at least 12 inches laid off in the cast iron bed or table in front of the knife. The amount of ruling that is laid off on the square shear (usually 12 inches) should be cut off of the steel rule, so that the figures on the rule will begin where they leave off on the square shear. Thus, when the rule is inserted in either of the grooves e, with its abbreviated end in juxtaposition to the square shear, a continuous measure is provided, beginning from the knife, so that it is not necessary to measure the length of the sections it is desired to cut. The only requirement is that the sheet be pushed through the shear and the end furthest away from the shear be brought on a line with the figure on the steel rule indicating the length desired. Then, by pressing the treadle, a piece of the required length is cut.

The grooves e should, of course, be cut, or stops provided in the same, in such a manner that the steel rule cannot be misplaced; or, in other words, so that the end nearest the square shear will be exactly in the proper place. The object in having three of the grooves e is to provide for the different widths of material. If only one groove, say e^2, is used, which is adapted to work 36-inch material, it would be inconvenient to work 24-inch material, because of the necessity for lean-

ing or reaching so far over the bench; whereas, if the steel rule can be quickly removed to the groove *e*, the inconvenient reaching is obviated. Everything which tends to make work easier and economize the vital force of the operator is important. Hence the three grooves.

It will, of course, be understood that a steel square can be used against the guage rule for the purpose of striking a line on the material perpendicular to the rule; or, if it is desired, an ordinary T square can be used to good advantage from the front edge of the bench. It would, however, be found advisable to have three squares of different lengths to suit the different widths of material, for the reason that a square of sufficient length to strike a line entirely across 36-inch material could not be used when the gauge rule is set for 24-inch material, as the rule would not allow the blade of the square to lie down on the material.

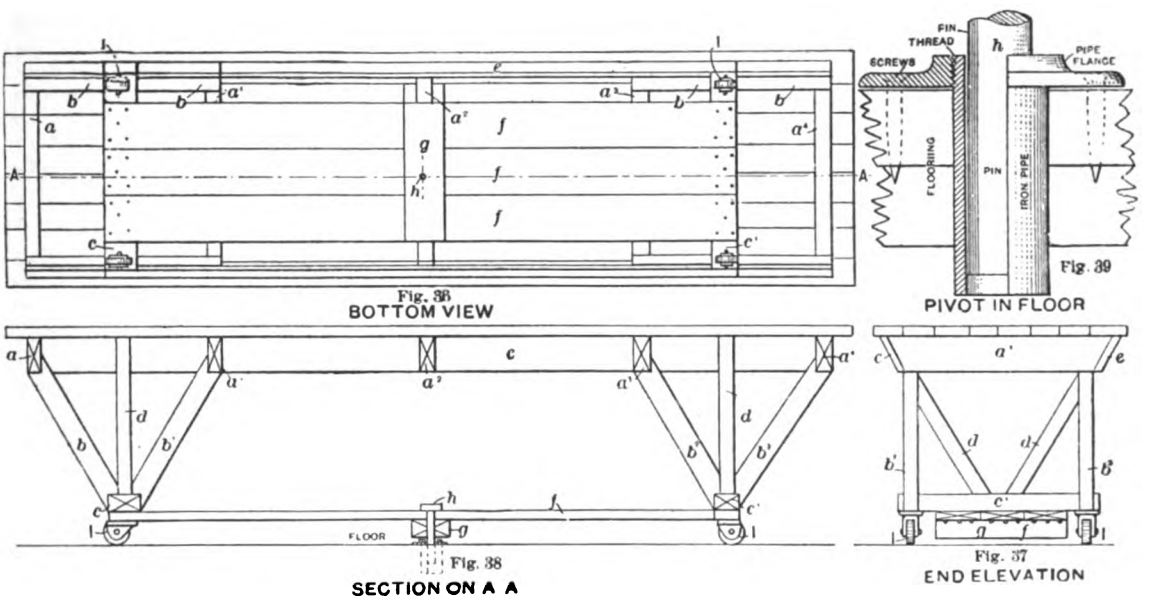
A REVOLVING BRAKE BENCH

Herewith is illustrated a revolving bench for use in front of either a hand or power brake, upon which to lay moldings in process of being formed. With the exception of stock moldings, for which special dies are provided, it is usually necessary to form a great majority of cornice work one bend at a time, and in doing so to reverse each sheet a number of times. A revolving bench enables the operator to make all similar bends in all the sheets, laying each partly formed sheet on the table in nested form; and when all the similar bends in all the sheets have been made, and the partly formed sheets laid on the table, and the next bend requires a reversal of the sheet, it is only necessary to turn the table end for end, which reverses all the sheets at once. It is then only necessary to take the sheets from the table and pass them directly through the brake again, repeating the operation as often as necessary.

A bench of this character, in addition to being strong and durable, should be as light as possible; and, in order to withstand the unusual strain of being rolled around while heavily loaded, it should be well braced. The construction shown is offered as one which meets all requirements. Fig. 36 is a bottom view looking up; Fig. 37, an end elevation; Fig. 38, a section on A A of Fig. 36, and Fig. 39, an enlarged half section and half elevation of the pivot connection to the floor at the center of the bench.

Assuming that 10-foot iron is used, the size of the bench should be 3 feet × 10 feet 6 inches, and the topping made of 1¼ × 6-inch hard wood boards, securely

nailed to cross beams a to a^4, which beams are 2×4 inches, and spaced as shown. Cross beams a, a^1, a^3 and a^4 are supported by the 2×4-inch braced legs b to b^2, which, in turn, rest on foot beams c and c^1. It will be seen that the legs b are placed in such a position that they brace the bench against longitudinal skewing and to prevent lateral skewing the braces d are provided. Secured at an angle to the ends of the beams a, and extending the full length of the bench on each side from beams a to a^4, are 1-inch planks, e. The braces d are secured to the planks e, as shown. The planks e should be kept at least 1 inch back from the edge of the bench and should slant inward at an angle of about 30 per cent. The overhang of the bench at the sides, beyond the ends of the foot beams c, should be at



Details of a Revolving Brake Bench

least 4 inches, so that no obstruction will be in the way of the operator's feet when standing close to the bench. The 1-inch boards are securely bolted to the bottom faces of foot beams c, and are tied together at the center by a 3×6 inch cross piece, g, with a 1-inch hole in the center to receive the 1-inch pivot bolt.

The platform made by the boards f and connecting foot beams c and c^1 resolves the entire bench into a girder, with the board f platform as the tension member and the topping of the table the compression member. This platform also provides the pivotal center for revolving the table and is, moreover, very convenient upon which to lay stays, tools, etc.

It will, of course, be understood that drawers can be provided both at the sides or ends of the bench, below tie board e, if desired. The entire table is

mounted upon four casters, *i*, pivotally secured to and near the ends of the foot beams *c*. The floor bearing for the 1-inch king pin *h* can be constructed as shown in Fig. 39, of a pipe flange and a piece of pipe of suitable size.

It is to be understood that the pin *h* of Fig. 38 is to be made removable, for it is often desirable to use this bench as a truck to cart, either the dotted off sheets from the cutting table to the brake, or the formed material to the assembling benches. This bench would also be useful at the large squaring shears.

DRAWING ROMAN MOLDINGS

In architectural design Greek and Roman moldings are employed. The outlines of Greek moldings, which are seldom employed in metal cornice work, follow the curves of the conic sections—*i. e.*, the parabola, the hyperbola and the ellipse. The circle is but rarely used. The Roman moldings are chiefly used in

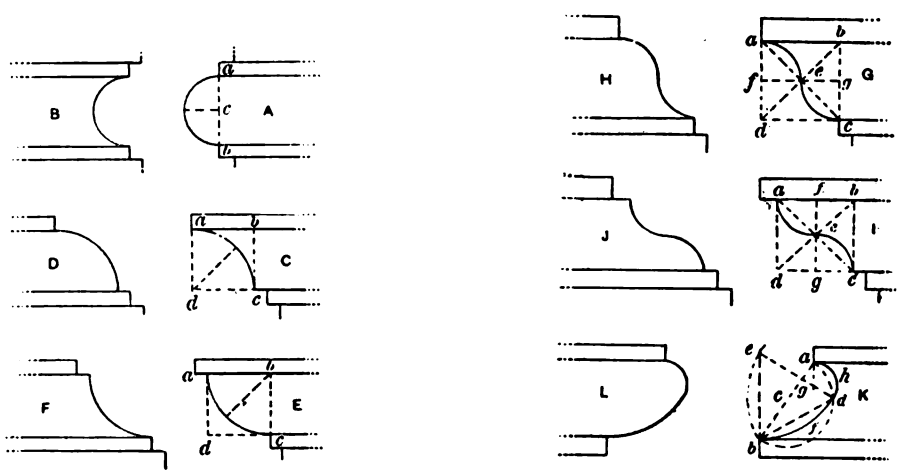


Fig. 40. Drawing Roman Moldings

metal cornices and are nearly always profiled to the arc of a circle or of two circles that are tangent. This accounts for the shape of the formers furnished with cornice brakes.

Some mechanics who do not understand the rules used in drawing Roman moldings, waste time and labor in trying to draw them free hand, when a little study would make them proficient.

In Fig. 40 are shown the various forms of Roman moldings. A is the *torus*, known in the shop as the *bead*. It is a semicircle struck from the center *c*, the bisection of *a b*.

The *cavetto* is shown at C, which is known in the shop as the *cove*. Its profile is a quarter circle and is obtained by completing the square *a b c d*, then using *d* as center to draw *a c*.

E is the *ovolo* and is a convex molding known to the cornice maker as a *quarter-round*. It is obtained in similar manner as the previous mold, excepting that the center point is at *b*.

G is the *cyma recta*, known in the shop as the *ogee*. It is composed of two quarter reverse circles tangent at *e*, struck from their respective center points, *f* and *g*, which are obtained by drawing the two diagonals, *a c* and *b d*, and through the intersection *e* draw *f g* parallel to *a b*.

I shows the *cyma reversa*, which is the reverse of the cyma recta, and is known as the *ogee reversed*. The method of construction is similar, excepting that the centers *f* and *g* are at top and bottom, respectively, while in G the centers are at the sides.

The mold known as the *scotia* is shown at K. This is called in the shop the *egg shaped* mold and is drawn as follows: After establishing the points *a* and *b* draw *a b*, which bisect and obtain *c*. Using *c* as center and *c a* as radius, draw the semicircle *b a*. Draw *b d* at an angle of 30 degrees with the base fillet, intersecting the arc at *d*. From *b* erect *b e*, and with *d* as center and *d b* as radius draw arc, intersecting *b e* at *e*. Draw *e d*, and from *a* drop a line, intersecting *e d* at *g*. Using *g* as center and *g a* as radius draw the arc *a h d*, and with *e* as center and *c d* as radius draw the arc *d f b*, completing the mold.

The molds shown by B, D, F, H, J and L are the reverse of those shown respectively by A, C, E, G, I and K, and show the various forms which can easily be drawn when the rules are understood. By following these rules and changing the profiles slightly to conform to the size formers in use, a great deal of time can be saved in forming.

FORMING MOLDINGS ON THE CORNICE BRAKE—I

The above subject is one to which very little attention has been given, considering its importance to sheet metal workers. None of the various manufacturers of cornice brakes seem to have considered this matter of sufficient importance to have pamphlets prepared illustrating the methods of operating their particular make of brakes. In response to numerous inquiries on forming mold-

ings and skylights on the cornice brake, the following article has been prepared, which is applicable to any style of hand brake in use.

The sections of the wooden or iron formers furnished with cornice brakes are usually half circles or segments. Therefore when drawing the full size details of moldings or cornices the curves should be made to correspond to the shape of the formers in use, if possible; if not, formers should be made to suit the molds, especially when large quantities of moldings are required.

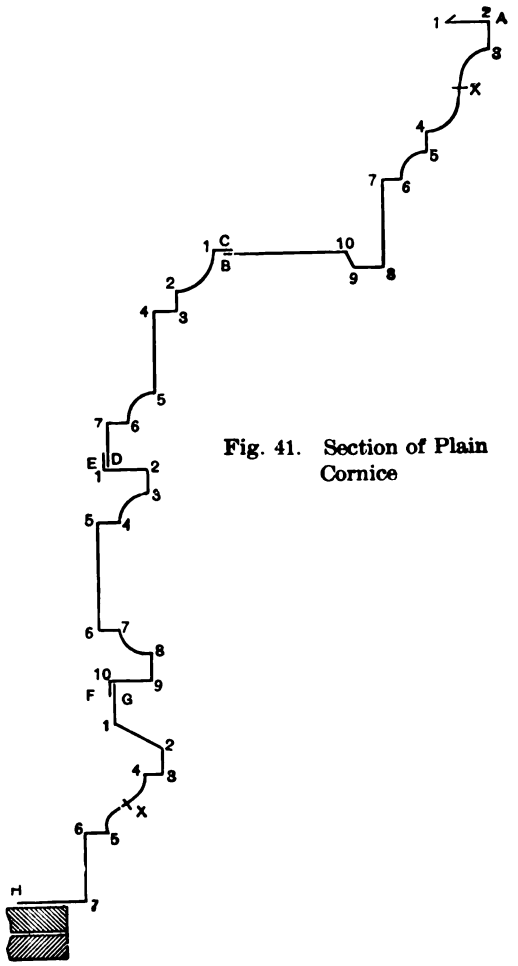


Fig. 41. Section of Plain Cornice

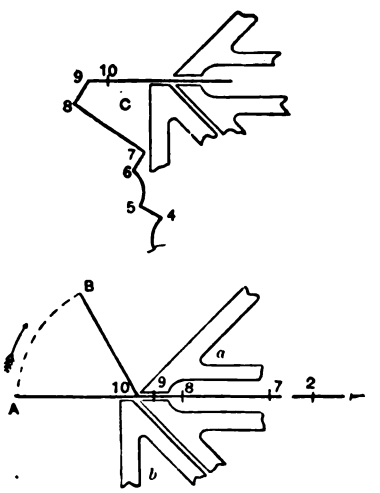


Fig. 42

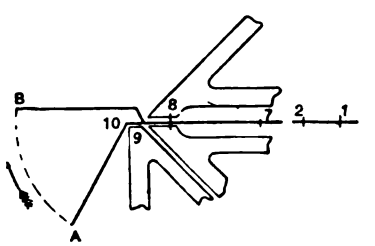


Fig. 43

The Cornice and Beginning of Operations

In Fig. 41 is shown a section of a plain cornice drawn according to the rules described in the preceding article with seams at B, D and G. Starting with the crown molding A B it will be illustrated step by step how the entire cornice is bent. It should be understood that an experienced hand on the brake can often devise simple methods and ways in forming, which results in saving time and labor. While in forming moldings one can start at different places on the flat

sheet, the size of the mold and the number of curves and the profile very often determine the dot at which the forming should be commenced.

Having obtained the stretchout or girth of the mold A B, the required number of sheets are dotted to represent points 1, 2, 3, X, 4, 5, 6, 7, 8, 9 and 10. If desired the start to form the mold could be made at either bend 3 or 4, but as the molding contains the drip 8 9 10, this would necessitate the forcing of the sheet at 8 9 to make the bend 10, as shown in diagram C in Fig. 42, of course, if the fascia mold, 7 and 8 is large this would be advisable as the metal would give, and by starting at 3 and 4 the ogee is more easily made. To avoid forcing, start the mold A B in Fig. 41 at the bend 10.

Place the sheet in the brake as shown by A 1 in Fig. 42. Close the top clamp *a* on dot 10, and raise the bending leaf *b* so that the angle B 1 corresponds to the profile or stay obtained from Fig. 41.

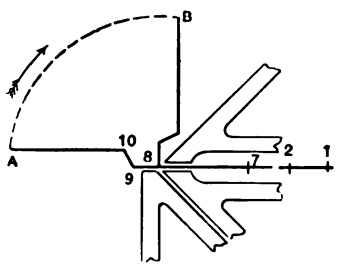


Fig. 44

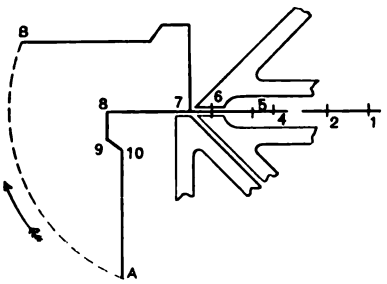


Fig. 45

Continuance of Operations

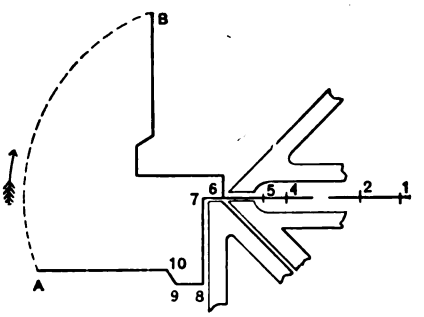


Fig. 46

In forming angles use the quadrant gauge, which is attached to some brakes, in which adjustable stops are used, working independently, which enables the operator to form bends of various angles without consuming valuable time in adjusting a stop for every angle formed. In practice the stop should be set so that when the handle of the bending leaf *b* in Fig. 42 is raised to touch the stop, it would give the desired angle, B 10 1, to the metal sheet being formed.

Next reverse the sheet B 1 and place it in the position shown by A 1 in Fig. 43; close the top clamp on dot 9 and, using the same stop, raise the bending leaf so that A 1 will have the position shown by B 1.

Do not remove the sheet from the brake, but simply draw it out to dot 8, as shown by A 1 in Fig. 44 and make the square bend B 1.

Reverse the sheet in the position shown by A 1 in Fig. 45 and on dot 7, and make the square bend shown by B 1.

Again reverse the sheet as shown by A 1 in Fig. 46, and on dot 6 make a square bend which brings the sheet as shown by B 1.

The next operation will be to form the cove 5 6 in Fig. 41. Three methods can be used in doing this. By the first, do not reverse the sheet shown by B 1 in Fig. 46, but simply draw the sheet out to dot 5, as shown by A 1 in Fig. 47. Make a square bend, which brings it to the position of B 1.

Place a former of the required size on the top edge of the bending leaf, as shown by *a* in Fig. 48, which fasten by the clamp *b*, when the molding A 1 is

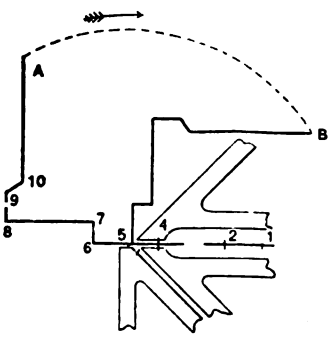


Fig. 47

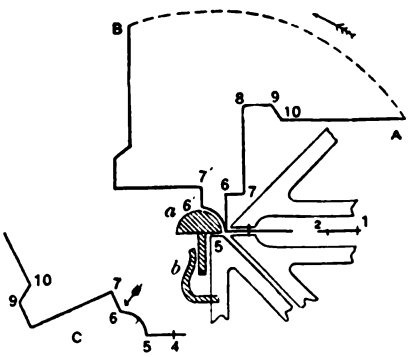


Fig. 48

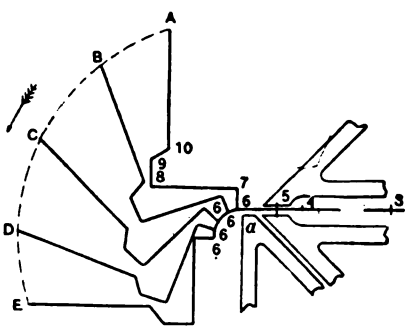


Fig. 49

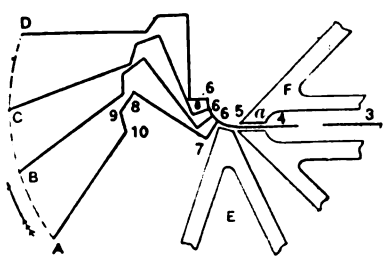


Fig. 50

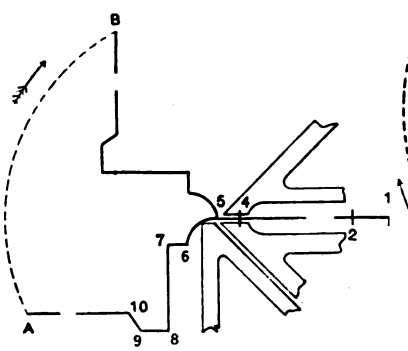


Fig. 51

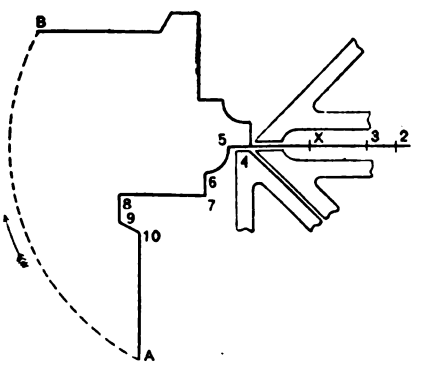


Fig. 52

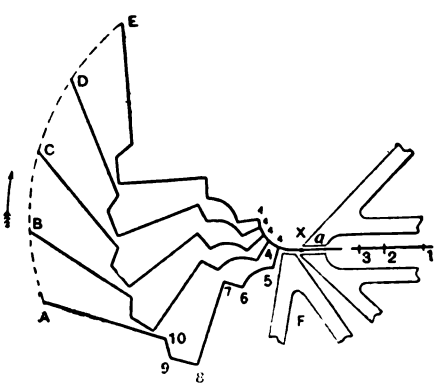


Fig. 53

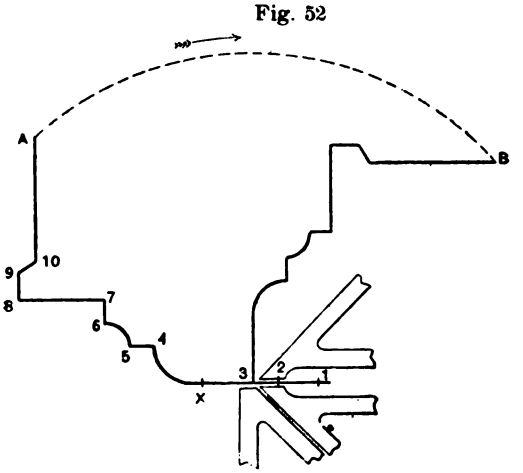


Fig. 54

Making the Bends of the Cove and Ogee

drawn over the former, bringing it in position shown by B 1. In forming this cove a former must be selected which is a trifle smaller in shape than the cove desired, because when forming the metal over the former the metal has a tendency tc spring back, which would make the cove larger than desired. Care must also be taken when pressing the metal over the former that the pressure be exerted on 7 6, so that when the cove is formed the line 7′ 6′ and 5 1 will be a right angle. If care is not taken by the operator he will be liable to exert pressure in the wrong direction, when the mold will look as shown in diagram C. In this angle 6 is out of shape.

The stay must now be fitted to 7′, 6′, 5, 4 to see whether the shape is true. These stays are profiles obtained from Fig. 41 and are cut from scrap metal.

The second method of forming the cove 6 5 can sometimes be used to advantage when forming various shapes of molds. In this the first is that of forming over the edge of the bending leaf, as shown in Fig. 49. In this case the sheet is bent as before described as far as shown by B 1 in Fig. 46. The distance between 6 and 5 is then marked off with pencil into equal parts on each end of the sheet, the smaller the mold the more spaces being required. The sheet is now drawn out to the first pencil mark and placed in position as shown by A 6 in Fig. 49 and a slight pressure exerted over the edge *a* of the bending leaf, when it will look as shown by B 6. In similar manner place the sheet on the next pencil mark, press downward, and it will look as shown by C 6. By pressing on each succeeding mark the sheet will take the appearance of D 6 and E 6, which completes the mold. Care must be taken to exert the pressure vertically, otherwise the angle 6 may appear as shown in diagram C in Fig. 48.

The third method of forming the cove is shown in Fig. 50, where the sheet B 1 in Fig. 46 is reversed and placed in the brake as shown by A 3 in Fig. 50. The bending leaf E is then tipped to a slight angle. Drawing out the sheet to the various pencil marks before explained, the top clamp F is opened and closed on the various pencil marks until the sheet assumes the shape of B 3, then C 3 and finally D 3.

Care must be taken in forming the mold as shown in Figs. 49 and 50 that too much pressure is not exerted, in the first case, and that the top clamp F is not brought down too quickly, in the second place, otherwise the cove will show a succession of lines or kinks.

Having obtained the shape true to the stay either as shown in Figs. 48, 49, or 50, the sheet is placed in the brake on dot 5, as shown by A 1 in Fig. 51, and a bend made true to the stay, when it will appear as shown by B 1.

Reverse the sheet in a position shown by A 1 in Fig. 52. Make the square bend at 4 shown by B 1.

The next step is to form the lower part of the ogee shown from 4 to X in Fig. 41. Reverse the sheet B 1 in Fig. 52 as shown by A 1 in Fig. 53. Divide each end of the sheet into equal parts between 4 and X and, tipping the bending

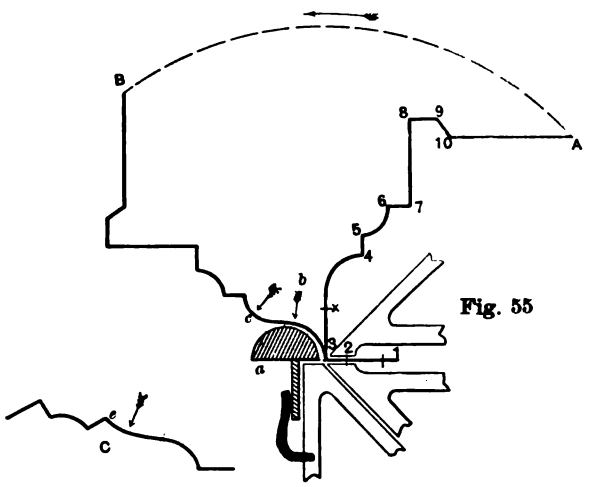


Fig. 55

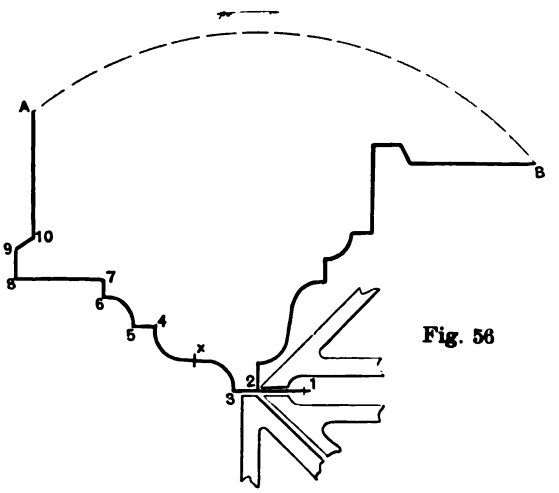


Fig. 56

The Last Bends of the Ogee

leaf F as shown, proceed to obtain the curve between 4 and X in a manner as explained in Fig. 50, which will bring the sheet to the various positions B X, C X, D X and E X.

Do not withdraw the sheet from the brake, but simply draw it out to dot 3, as shown by A 1 in Fig. 54. Close the top clamp and make a square bend, as shown by B 1. Now take a former a trifle smaller than the stay requires and place it on the edge of the bending leaf shown by *a* in Fig. 55. Press A 1 over same, exerting the pressure at X, when it will look as shown by B 1. After the molding has been only slightly turned over the former *a* always keep exerting the pressure in the direction of *b* and not at *c*, otherwise the lower part of the ogee will be pressed out of shape and be apt to look as shown in diagram C at *e*.

Do not reverse the sheet, but draw out to dot 2, as shown by A 1 in Fig. 56, and make the square bend B 1.

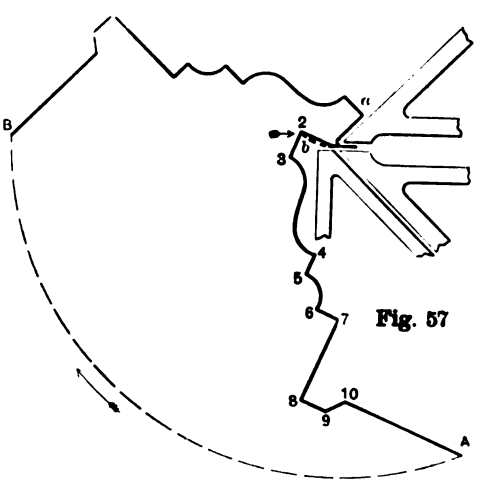


Fig. 57

Final Operation for Crown Molding

Reverse the sheet so as to bring it in position to form the lock at dot 1. As some of the finished bends will strike against the bending leaf, as shown in Fig. 57, the sheet will have to be forced slightly at bend 2, so that the top clamp can be closed on dot 1 and will cause the metal between 2 and 1 to spring slightly, as shown by the dotted line *b*. In forcing the top edge 2 1 care must be taken that the distance from 2 to 1 is equal throughout the entire length of the sheet, for otherwise the bend 2 when sighted will be curved. Having done this, turn the edge as far as the machine will make it, as shown by B *a*, which completes the forming of the crown molding from A to B in Fig. 41.

FORMING MOLDINGS ON THE BRAKE—II

The next mold to be formed is the modillion course, shown from C to D in Fig. 41, part 1. After the sheets have been dotted the forming could be started at either dot 1, 2, 5 or 6, as it is customary to start at a cove. In this case start at dot 5. Therefore place the sheet in the brake, close the top clamp on dot 5, as shown in Fig 58, and make the square bend B 1.

Leaving the sheet in that position, as shown by A 1 in Fig. 59, place the required size former *a* in position, fastened by the clamp *b*, and press down A 1 no further than to 6′, which will appear as B 1.

Now place 6′ in the brake, as shown by A 6 in Fig. 60, and make a bend on dot 6. This will bring B 6 true to the stay.

Reverse the sheet shown in the position by A 7 in Fig. 61, close on dot 7 and make a square bend, shown by B 7, which completes the lower portion of the molding.

Reverse the sheet and close the top clamp on dot 4, as shown in Fig. 62, and make the square bend B 1.

Again reverse the sheet, as shown by A 1 in Fig. 63, and make the square bend on dot 3, as shown by B 1.

Reverse the sheet, as shown by A 1 in Fig. 64, and make the square bend on dot 2, as shown by B 1.

Draw out the sheet to dot 1, as shown by A 1 in Fig. 65, and make a square bend at 1, as shown by B 1. It will be noticed that when making this bend the finished bend *a* strikes against the upper clamp, making a slight curve at *b*, which does no harm.

Now, leaving the molding in the brake in this position, as shown by A 1 in Fig. 66, place the required size former *a* in position, fastened by *b*. Press over A 1, exerting the pressure in the corner *c* and in a vertical position on 3 2, bring-

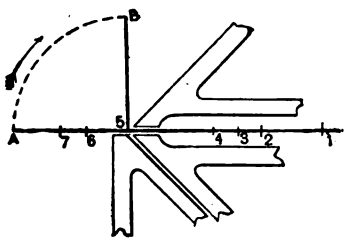


Fig. 58

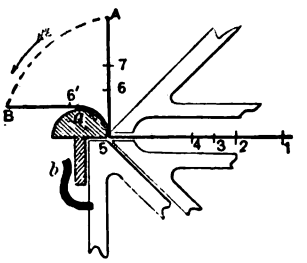


Fig. 59

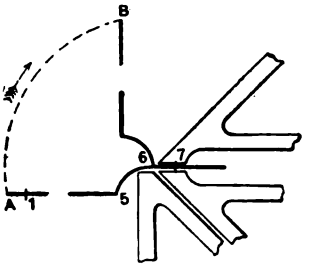


Fig. 60

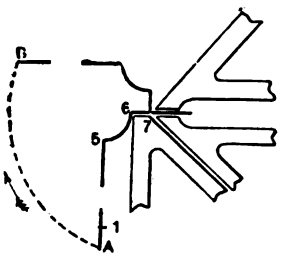


Fig. 61

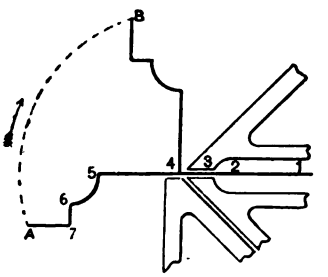


Fig. 62

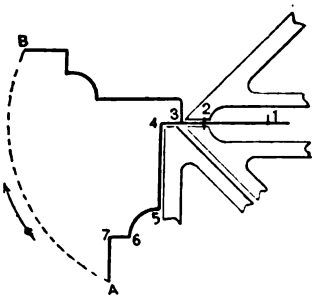


Fig. 63

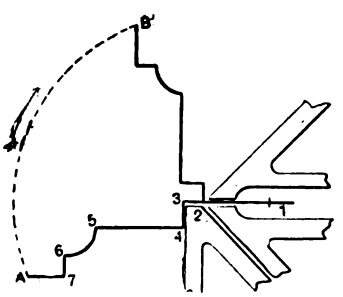


Fig. 64

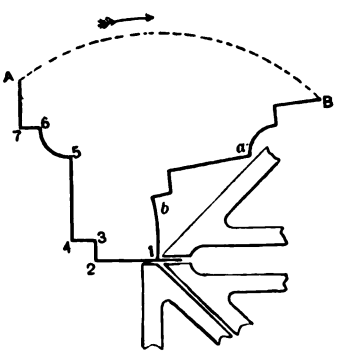


Fig. 65

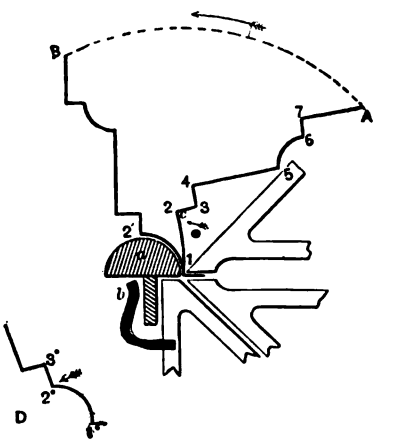


Fig. 66

Complete Operations for Modillion Course

ing it over until 2 touches the former at 2′. If the molding is drawn over the former in a horizontal line it is apt to change the angle 2′ to that shown in diagram D by 2°, which is to avoided. This completes the forming of the modillion course shown from C to D in Fig. 41.

It is possible that the inexperienced may be confused in the various turning of the molds, and it is suggested that they take a small strip of metal, about ¼ inch

wide, and a small pliers, and, numbering the strip to correspond to the molds formed, follow each diagram, reversing as described, and make the bend and molds with the pliers as each diagram shows. In this way the method will be interesting and instructive.

The next mold in order is the panel course shown from E to F in Fig. 41. In this case, as before, you could start at 3, 4, 7 or 8. If, however, you started at 4 or 7, the sheet would have to be forced into the brake to make the bends 1 and 10, respectively, and to avoid this the cove should be started at 3 or 8. In this case start at 3.

Place the dots 1 and 2 in the brake and close on dot 3, as shown by A 1 in Fig. 67, and make the square bend shown by B 1. Leaving the sheet in this position, place the required size former in position, as shown by *a* in Fig. 68, and turn down A 1 until dot 4 touches the former at 4′, bringing the sheet as shown by B 1.

Do not reverse the sheet, but draw it out to dot 2, as shown by A 1 in Fig. 69, and make a square bend, as shown by B 1. Reverse the sheet in the position shown by A 1 in Fig. 70, and make the square bend shown by B 1.

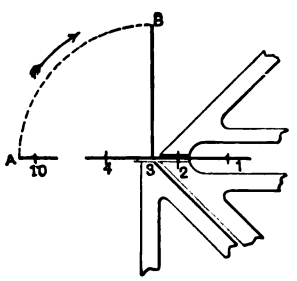


Fig. 67

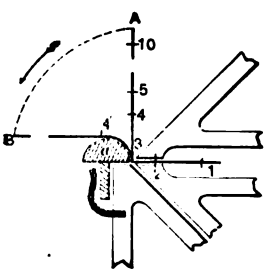


Fig. 68

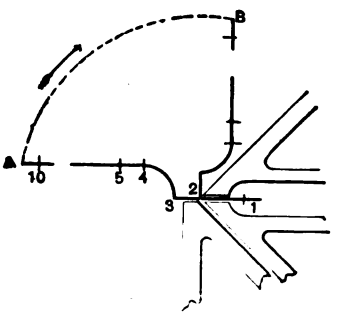


Fig. 69

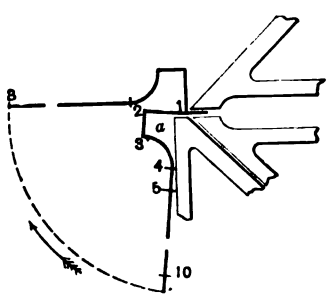


Fig. 70

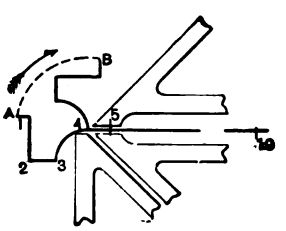


Fig. 71

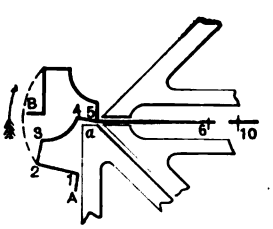


Fig. 72

First Operations for Panel

In forming panels of this shape this method should always be followed, for had 4 and 5 been bent first the panel must necessarily be forced to make bend 1.

Reverse the position of the panel and place it in the brake shown by A 10 in Fig. 71, and make a bend on dot 4, which will bring B 5 true to the stay.

Reverse B 10 and place it in the brake, as shown by A 10 in Fig. 72. In this case bend 1 strikes the bending leaf and the panel must be slightly forced at 4 so that the top clamp can be closed at 5. This will cause the metal to spring a little, as shown by the curve *a* between 4 and 5, which can be pressed back again with the fingers after the bend B 5 has been made.

Do not reverse the sheet, but draw it out to dot 6, as shown by A 10 in Fig. 73, and make the square bend B 10.

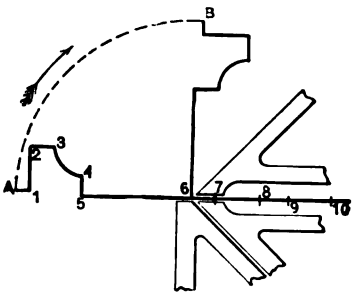


Fig. 73

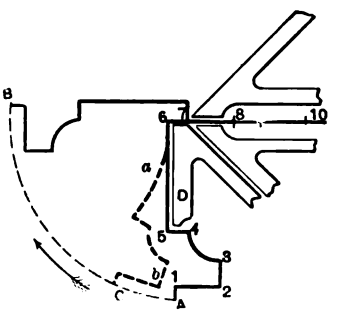


Fig. 74

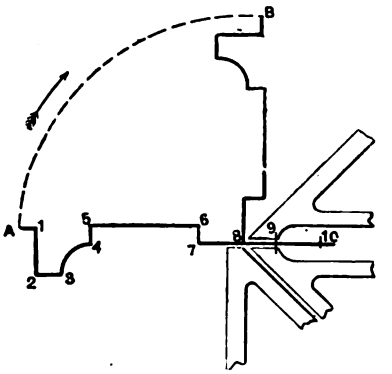


Fig. 75

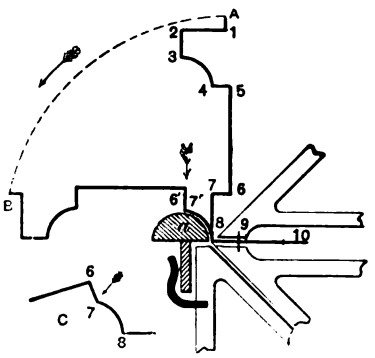


Fig. 76

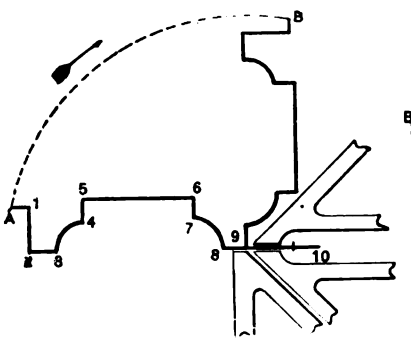


Fig. 77

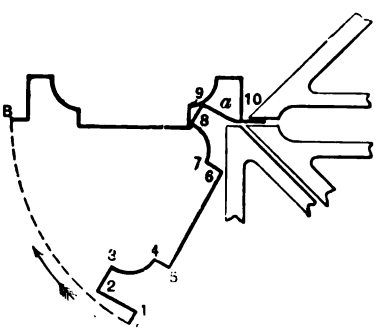


Fig. 78

Final Operations for Panel

Reverse the sheet, as shown by A 10 in Fig. 74, and make the square bend on dot 7, as shown by B 10. If, however, the panel which is being formed were a long one, the lower part of the panel 2 3 would strike against the bending leaf D, as shown at *b*, and in forcing the bend 6, so as to make the bend 7, the flat part of the panel *a* would curve slightly, as shown, which, however, would straighten again when bent in the position shown by B 10.

Draw out the sheet B 10 and close the top clamp on dot 8, as shown by A 10 in Fig. 75, and make a square bend, as indicated by B 10.

Place the former *a* in position, as shown in Fig. 76, and exert the pressure on the line 6 7, as shown by 6′ 7′. Care must be taken not to press the angle out of shape at 7′ or else it will look as shown at 7 in diagram C, and is very difficult to bring back in its proper shape without changing the profile of the cove.

Remove the former and draw out the sheet to dot 9, as shown by A 10 in Fig. 77, and make the square bend B 10.

Reverse the sheet and force slightly in the brake, as shown by A 10 in Fig. 78, which will cause the space between 9 and 10 to curve slightly, as shown at *a*, and close the bending leaf on 10 and make a square bend, as shown by B 10, which completes the panel shown from C to D in Fig. 41.

The last mold to complete the cornice is the foot mold, shown from G H. Obtain the stretchout of this mold, being careful to obtain the dot X, showing the center between the concave and, convex mold. In this case you can start at dot 4

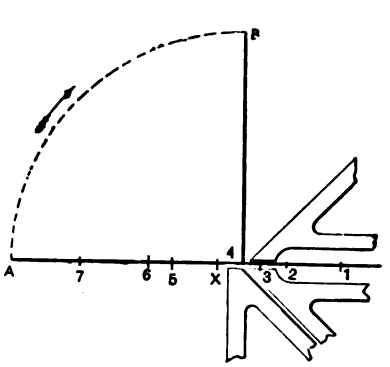


Fig. 79

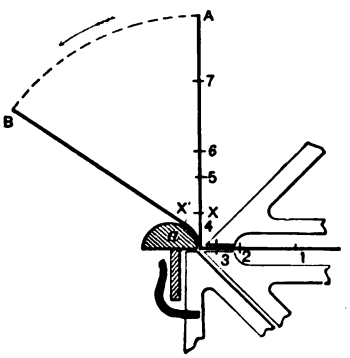


Fig. 80

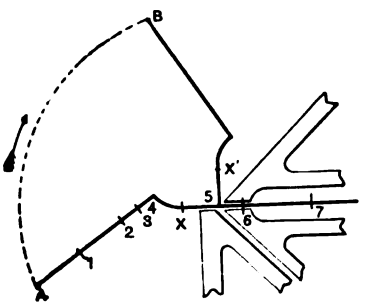


Fig. 81

First Operations for the Foot Mold

or 5. Place 1, 2 and 3 of the sheet in the brake in Fig. 79, as shown by A 1, and make a square bend on dot 4.

Keeping the sheet in this position, place the required former on the bending leaf, as shown by *a* in Fig. 80, and press down the sheet on the former until the dot X touches the former at X′.

Reverse the sheet, as shown by A 7 in Fig. 81, and make a square bend on dot 5, as shown by B 7.

Place the same former in position as shown in Fig. 82, and press down A 5 until X touches the former at X′, as shown by B 7. Care must be taken in forming not to press the previous shape out of position, and before going any further to see that the ogee is true to the stay.

Having done this, reverse the sheet and place in position on dot 6, as shown by A 7 in in Fig. 83, and make a square bend, as shown by B 7.

Reverse the sheet on dot 7, as shown by A 7 in Fig. 84, and make the square bend as indicated by B 7.

Place the sheet in the brake on dot 3 in Fig. 85, shown by A 1, and make a square bend, which will bring it in position shown by B 1.

Do not take the sheet out of the brake, but draw it out to dot 2, as shown by A 1 in Fig. 86, and make a bend to correspond to the angle required on the stay, as shown by B 1.

Having this angle accurate, set the stop and reverse the sheet, as shown by A 1 in Fig. 87, and using the same stop make a bend on dot 1, which will bring the

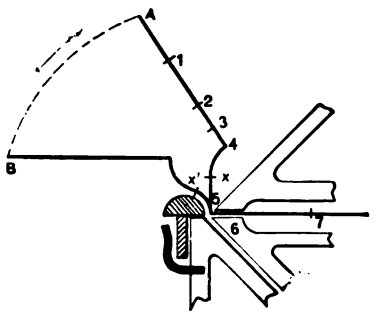


Fig. 82

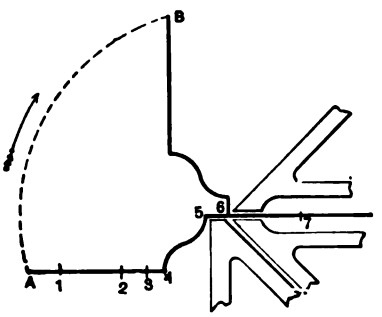


Fig. 83

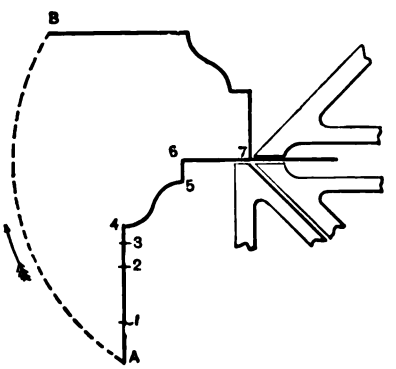


Fig. 84

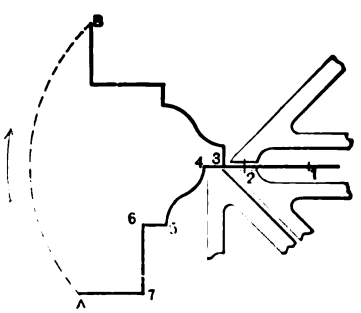


Fig. 85

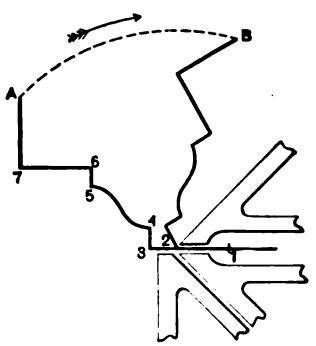


Fig. 86

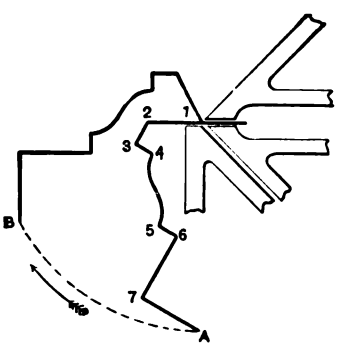


Fig. 87

Final Operations for the Foot Mold

mold in position shown by B 1. This completes the foot moldings, being the last of the molds for the entire cornice shown in Fig. 41. The methods just described can be applied to moldings whether in the form of a cornice, lintel, ceiling cove, ventilator, finial, etc.

It is to be understood that if cornice had a drip at the foot where it sets on the wall, the foot molding would then be formed by making the drip first, the ogee part being formed by making small bends as previously described.

FORMING MOLDINGS ON THE CORNICE BRAKE—III

Sometimes large moldings must be formed similar to that shown in Fig. 88, and the formers are too small to be of any value. In that case the mold is made by "braking up" on the brake. The method of doing this is as follows.

Divide the cove between 2 and 3 into equal parts, as shown from *a* to *g*, and transfer this stretchout by means of dots or pencil marks on the sheet.

Make the first square bend on dot 2, as shown by A 4 in Fig. 89, then set the bending leaf A in Fig. 90 to a slight angle and reverse the sheet A 4 in Fig. 89 to the position shown by 1 4 in Fig. 90.

Then drawing out the sheet to *a*, close the top clamp B slowly but firmly; again draw out to mark *b* at either end and again close the top B; or, in other words, as B is opened, draw out to the next mark, then close B, and so on, until the sheet has the shape shown by 1′ 2′ 4.

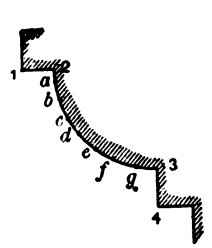


Fig. 88

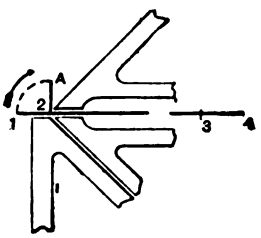


Fig. 89

In doing work of this kind if care is not taken a succession of lines or kinks will show in the molding, as shown from

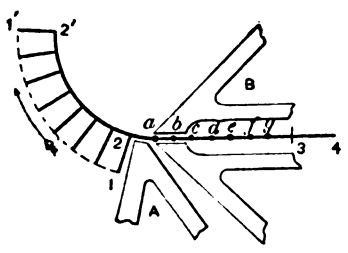


Fig. 90

Fig. 91

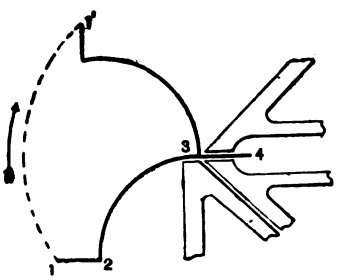


Fig. 92

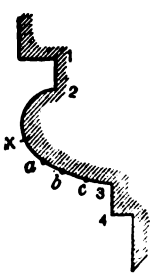


Fig. 93

Large Moldings and Forming Operations of One

a to *f* in Fig. 91, which kinks are, of course, to be avoided. It should be understood that the more the bending leaf A in Fig. 90 is tipped, and the closer the spaces between *a* and *g* are placed, and the tighter the top clamp B is closed, the smaller will the cove be, while the less A is tipped, the wider the spaces between *a* and *g* are spaced, and the tighter B is closed, the larger will the cove be.

Having formed the cove, as shown in Fig. 90, reverse it on dot 3 in Fig. 92, as shown by 1 4; make a square bend as shown by 1′ 4, which completes the cove. The square bends are made in the usual manner.

Fig. 93 shows another form of molding, known as the reverse of the *scotia*, and is formed by using the former for the part shown from 2 to X and "braking" the

part shown from X to 3. Space the portion between X and 3 in equal parts and transfer them on the sheet. Then to form this proceed as follows:

Make the square bend on dot 2 as shown by 3 1 in Fig. 94, place the required former *a* in position and press down the sheet 3 2 until X touches the former at X^1, the joint X representing the end of the small arc and the commencement of the larger one.

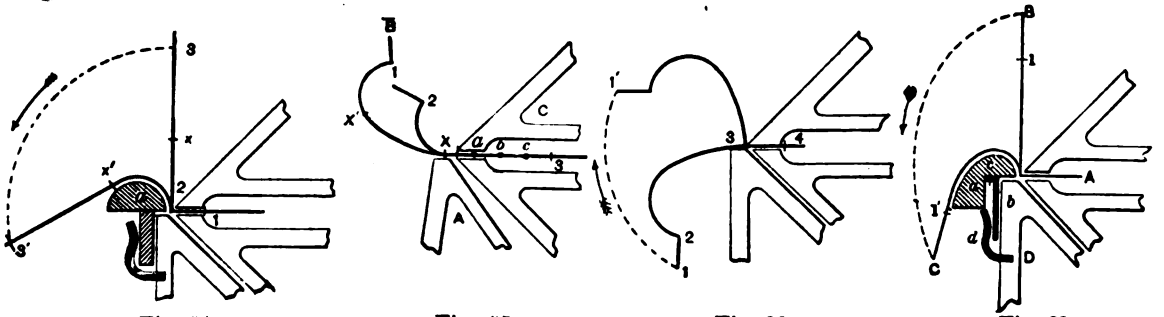


Fig. 94 Fig. 95 Fig. 96 Fig. 97

Operations to Form Molding Fig. 93

Now reverse the sheet and place it in the position shown by 1 2 X 3 in Fig. 95, and slightly tip the bending leaf A. Now draw the sheet out to *a*, close the top clamp C, then open and again close the clamp at *b*, and so on, until the shape B X^1 3 is obtained, being sure it is true to the stay. Having done this, reverse the sheet in the brake on dot 3, as shown by 1 4 in Fig. 96, and make the bend 1′ 4 true to the stay; the other bends, shown in Fig. 93, are made in the usual manner.

When a shape similar to Fig. 93 is to be made in small size or when any other shape that can be made at one operation is desired, providing a large quantity of molding is required, special formers can be constructed similar to that shown in Fig. 97. Assuming that a *reversed scotia* mold is to be made, have a wood turner cut the former *a* a trifle less than the required profile (to allow for the spring in the metal). It should be as long as the brake in use. Make three band iron angles of $\frac{1}{4} \times 1\frac{1}{2}$ inch metal, and screw them in position at *c*, being careful that they are placed directly in line with the clamps *d* in the bending leaf D.

Then first make the square bend as shown by B A, place the former *a* in position, and draw B over the former until 1 (the amount of material required to make the mold) touches the former at 1′, as shown by C A, after which the bend at 1′ can be made to suit the required stay.

When a molding is to be formed similar to that shown in Fig. 98 by A B, which consists of a cove and ogee combined, the method is as follows: Obtain the stretch-out 1, 2, *a*, *b*, 3, X, 4, 5, 6, and commence to form at 4. On this make a square bend, as shown by 1 4 6 in Fig. 99. Place the former *a* in position and press down

the piece 1 4, as shown by 1′ X′, or until X touches the former at X′. Reverse the sheet, as shown by A 1 in Fig. 100, and make a square bend on 3, as shown by B 1. Again put the former *a* in position, as shown in Fig. 101, and press down B 1, as shown by A 1, or until X touches the former at X′. Care must be taken not to press the upper cove out of shape.

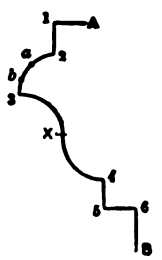


Fig. 98

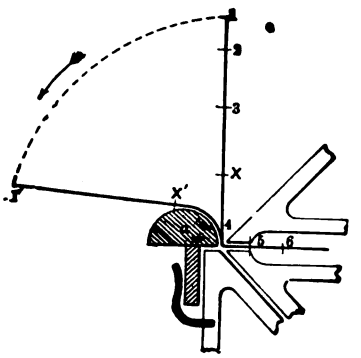


Fig. 99

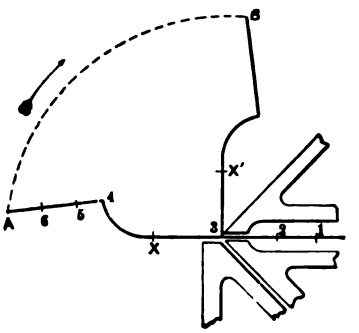


Fig. 100

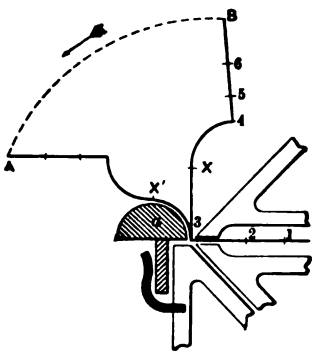


Fig. 101

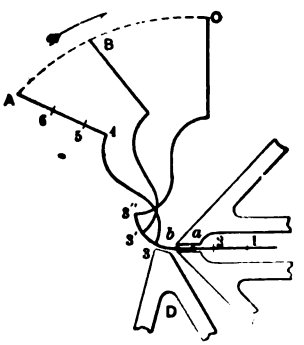


Fig. 102

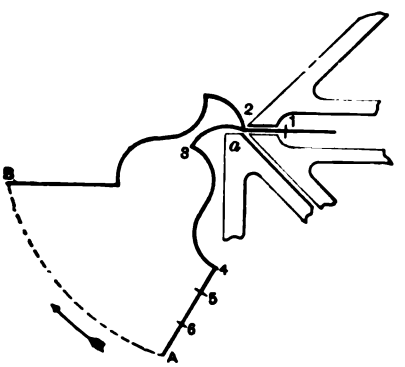


Fig. 103

Complicated Molding and Forming Operations

If the ogee is true to the stay tip the bending leaf D of Fig. 102, insert the sheet, as shown by A 1, and close the top clamp on the mark *b*. Now draw it out to dot *a*, close clamp and it will look like B 1. Do the same on dot 2, giving the shape C 1. If the shape is true to the stay, reverse the sheet in the brake in the position shown by A 1 in Fig. 103. Raise the bending leaf *a*, and obtain B 1. The balance of the square bends required to complete the profile shown in Fig. 98 are obtained in the usual manner.

In Fig. 104 is shown a still more difficult profile to form, containing a bead, cove and drip. In bending moldings of this kind the bead is usually formed first, thereby making it necessary to force the metal to enable one to bend the drip. By forcing the metal the bends previously made get out of shape, and the methods employed in regaining these shapes by means of the tongs will be carefully described.

After the stretchout of the mold has been dotted upon the sheets, start at either dot 5 or 6. By starting at dot 6 one operation is saved in reversing the sheet. Therefore place the sheet from 6 to 11 inside of the brake and make a square bend on dot 6, as shown by A 11 in Fig. 105. Place the required former *a* in position and press the sheet A over the former, as shown by B. Now reverse the sheet, as shown by B 1 in Fig. 106, and make a square bend on dot 5. Again place the former in position, as shown in Fig. 107, draw down A over the former, which completes the bead B 1. Having started on dot 6 you need not reverse the sheet, but simply draw out to dot 4, as shown by 11 1 in Fig. 108, and make a square bend, as shown by A 1. Now reverse the sheet as shown by A 1 in Fig. 109, and force the sheet at the point 4, so that the top clamp can be closed on dot 3, and make a square bend, as shown by B 1.

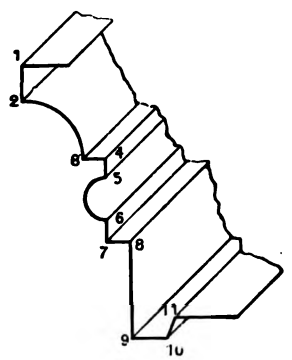


Fig. 104

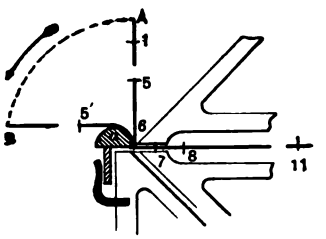


Fig. 105

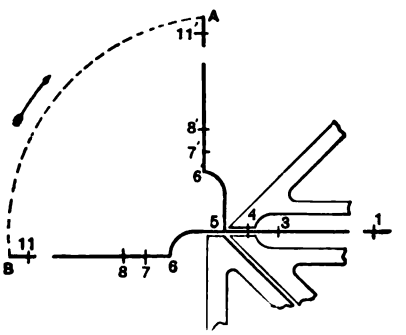


Fig. 106

An Involved Case and First Operation of Forming

By forcing the sheet at 4 the angles 4 and 5 are slightly pressed out of shape, so that when the sheet is drawn out to dot 2 in Fig. 110 it will look as shown by A 1, while it ought to have the shape shown by B 1, which is obtained by using a tongs, shown at *a* having faces *b*, *c*, and each are about 6 inches long. These tongs are placed in the position shown when the angle 5 4 3 is pressed together, bringing A 1, as shown by B 1. A square bend is now made on dot 2, as shown by C 1, and the required size former *a* placed in position, as shown in Fig. 111, when A 1 is drawn over the former, as shown by B 1. Again draw out the sheet to dot 1 and make a square bend. Thus it will be seen that the bends 3, 2 and 1 are made without removing the sheet from the brake.

Now make the square bends 7, 8 and 9 in the usual manner, as shown in Fig. 112, when the drip is ready to be formed. After the square bend 9 has been made draw out the sheet to dot 10, as shown by 1 11 in Fig. 112, and make the bend on dot 10 true to the stay, as shown by 1′ 11. Reverse the sheet, place it in the brake,

as shown by A C in Fig. 113, force the sheet on 9 10 and close the brake on dot 11, make a bend to the required shape, bringing the sheet in the position shown by B C.

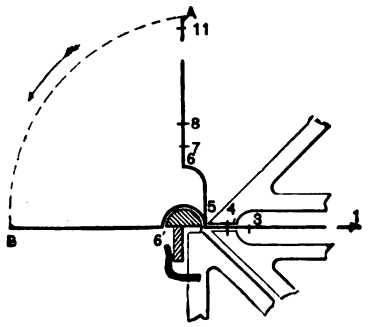


Fig. 107

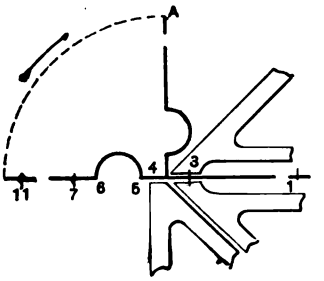


Fig. 108

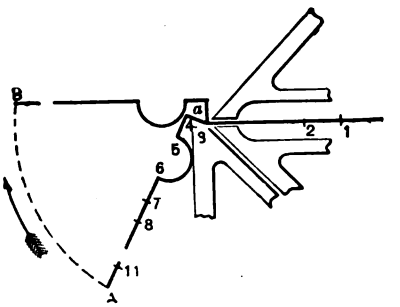


Fig. 109

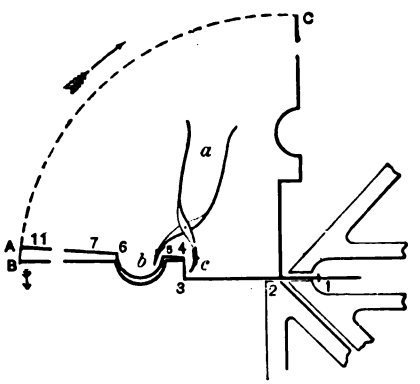


Fig. 110

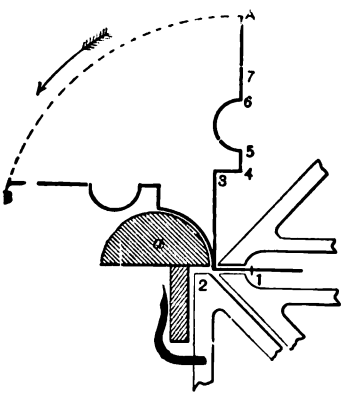


Fig. 111

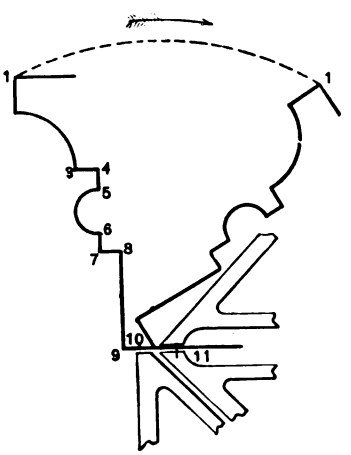


Fig. 112

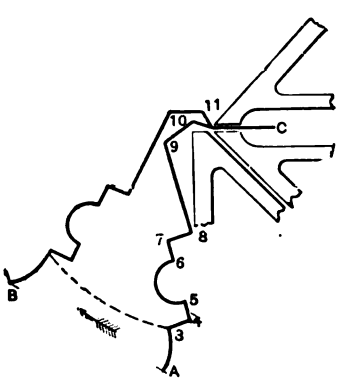


Fig. 113

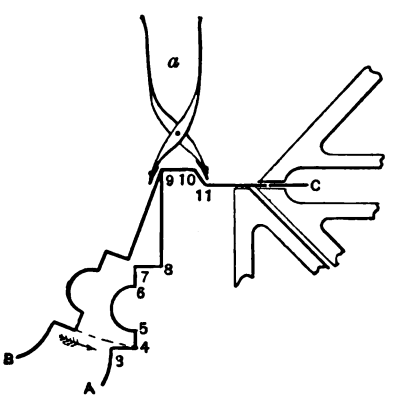


Fig. 114

Final Operations in Forming the Involved Case

To give more working room draw the sheet outside of the bending leaf and close the top clamp, as shown in Fig. 114. The tongs *a* are then employed in the position shown, and the sheet B C brought back to its original shape, A C.

For very small coves, iron rods are used, with cleats of tin, as shown at A, Fig. 115, fastened around them in the manner shown at X; the rod B is a trifle smaller than the cove to be formed. The bending operations are as follows: Make the square bend shown by B C, Fig. 115. Open the top clamp and insert flanges of rod and then the sheet to be formed. Close top clamp and turn B over the rod as shown by D C, and proceed to form in the usual manner.

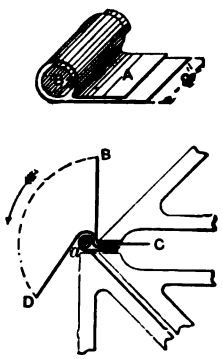


Fig. 115

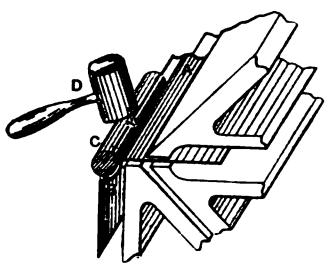


Fig. 116

Forming Small Coves

If the cove is too flat, place the sheet in the brake as shown by Fig. 116 and with a rod C and mallet D, deepen the cove by striking the rod with the mallet having the helper hold sheet at the bottom B during the operation

FORMING FLUTED COLUMNS

In forming flutes of the kind Fig. 117, the flute must not enter the inside of the brake; for, when closing the top clamp, the flute would be flattened down. In Figs. 118 to 122 inclusive are shown the various operations required to form a fluted column. In Fig. 118 A is the top clamp, B the bending leaf and C the bottom clamp of the cornice brake. The sheet of metal, E, is clamped and bent square, as shown by F. The former, D, is then placed in position, and F is drawn over it, as shown by G, which completes the first operation. The sheet is now taken and placed between the clamps, as shown at A in Fig. 119, and in its proper position, the bend made as shown by B. Then, with the former in position, B, it is drawn over the former to the shape shown by C, which completes the second operation. Thus it will be seen that only on the first flute can the former be used for the right and left molds. Having now completed one flute, A, in Fig. 118, and to obtain the curve B the third operation must be gone through, shown in Fig. 120.

Take the sheet C A in Fig. 119 and place it in the brake, as shown by A *a* in Fig. 120, and slightly raise the bending leaf B°. Then draw out the sheet a little further and again slightly raise the bending leaf, when the sheet will look as shown by B *a*. Continue in this manner, always drawing out the sheet about ¼ inch at a time, as shown by C *a*, D *a*, etc., which gradually gives the desired curve. In its proper position make the square bend E *a*. Care should be taken not to raise the

bending leaf too much at a time, otherwise bends will show. Another way to obtain slight curved surfaces is to slightly raise the bending leaf to a stationary position, then by means of the handle on the upper clamp of the brake, open and close the top clamp, always drawing out the sheet after each pressure.

Take the sheet E *a* and place it in the brake, as shown by A *b* in Fig. 121. Obtain the half section of the flute by raising the bending leaf B, or by opening and closing the top clamp, as previously described, thus obtaining the

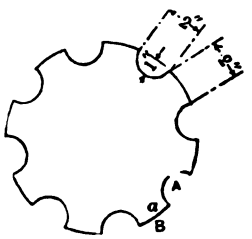


Fig. 117. Section of Column

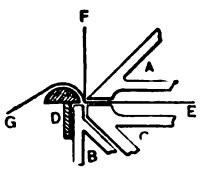


Fig. 118. First Operation

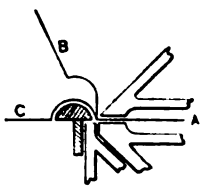


Fig. 119. Second Operation

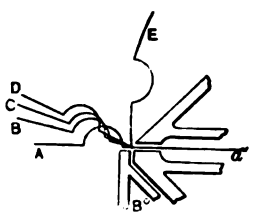


Fig. 120. Third Operation

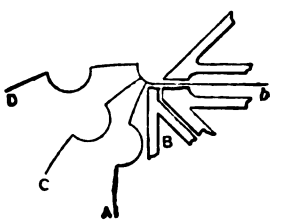


Fig. 121. Fourth Operation

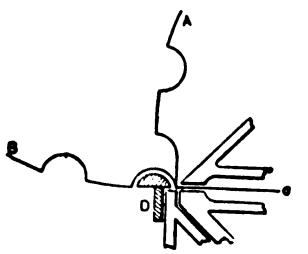


Fig. 122. Last Operation

gradual curves C *b*, D *b*, etc. Now take the sheet D *b* and place it in the brake in Fig. 122, and in its proper position make the bend A *c*. Place the former D on the bending leaf, and press down A, which will look as shown by B. Thus one of the inside flutes is made. It is to be understood that the column is to be made in halves to facilitate the operations of forming, for it would require considerable forcing, with the likelihood of misshaping if made in one piece. For the balance of the flutes proceed in precisely the same way as described in connection with Figs. 120, 121 and 122. Care must always be taken to get the true angles at *a* in Fig. 118 so that the outline will be a true curve. A little practice will make perfect.

FASTENING METAL ENRICHMENTS ON MOLDINGS

In constructing sheet metal work various forms of enrichment are used, and the method of fastening them to the various shaped molds is shown herewith. The zinc enrichments are used on galvanized iron work and the copper enrichments on

copper work. On galvanized iron work the enrichments can be soldered on the outside, as the work, when completed, is usually painted, but on copper work, where the outside must show a clean surface, the copper enrichments are usually riveted or cleated with copper wire, as will be explained in Figs. 123 to 126.

In construction the metal moldings should be formed to such a profile as will allow the enrichments a true and even bed. The enrichments should be trimmed close and attached as will be described. By continuing the sheet metal molding under the enrichment a stronger and neater job is made and is much better than the old plan of joining the metal to the enrichment at each side, as will be explained

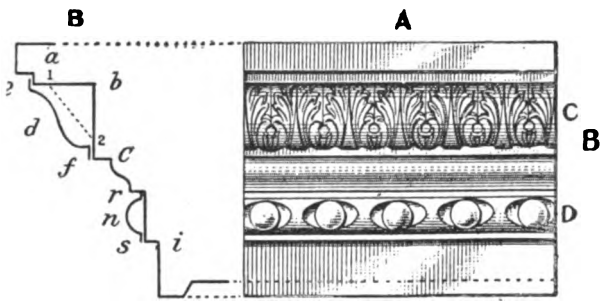


Fig. 123. Section Elevation

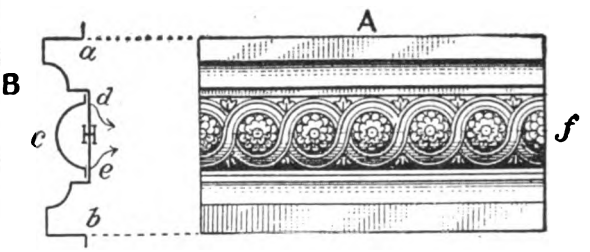


Fig. 125. Section Elevation

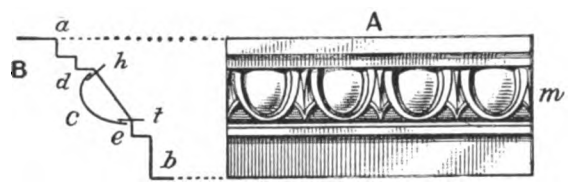


Fig. 124. Section Elevation

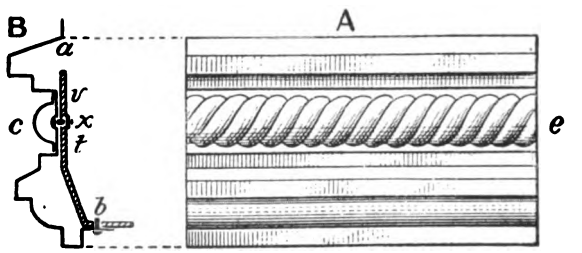


Fig. 126. Section Elevation

General Design of Moldings

in connection with Fig. 125. Not alone is a better job obtained, but it removes the difficulties arising from expansion and contraction, especially when zinc is attached to the galvanized iron on each side.

Referring to the illustrations, let A in Fig. 123 represent the elevation of a crown mold, on which the enrichments C and D are to be fastened. The method of fastening these two enrichments is shown in the section B, in which *a b c* or 1 2 shows a solid background, to which the enrichment *d* is fastened at *e* and *f*, either soldering or riveting, as desired. In similar manner the molding is continued in one piece, as shown by *c i*, fastening the enrichment *n* at *r* and *s*, the same as before.

In Fig. 124, A shows the elevation of a bed mold, to which the egg and dart enrichment *m* is to be fastened, as shown in section B. The molding is formed in one piece, as indicated from *a* to *b*, and if the molding is galvanized iron and the enrichment *c* is zinc, it can be fastened by soldering in the corners *d* and *e*; if, however, the molding and enrichment are copper, copper wires about 1½ inches long shown by *h* and *t*, are soldered at *d* and *e*, respectively; then, using the prick punch, holes are punched into the molding in their proper places, the wires inserted, drawn taut with the plyers at the back and turned over to hold the enrichment in position. The wire, of course, is soldered to the back for additional strength, and oftentimes copper cleats are used instead of wire; these cleats are usually 2 in. wide and instead of just punching a hole in for wire, slits are made in the molding, at the proper place, by means of a very sharp cold chisel, holding a block of wood at the back to prevent brusing the molding.

The method of locating the positions where the holes are to be punched in the molding is as follows: When the copper wires *h* and *t* are soldered to the enrichments at intervals of 12 or 15 inches, mix a little whiting (ground chalk) with water, to make a thin paste; dip the wires in it, then set the enrichment on the molding in its proper position, when the location for punching the holes in the molding will be indicated by small white dots. This is a simple method and hardly takes as long in practice as it does to describe it here. When the holes are punched at random a number of holes is the result, and the wire has no firm hold when turned over in the back, thus allowing the enrichment to move back and forth, necessitating tacking with solder on the face of the molding.

In Fig. 125, A is the elevation of a panel with the enrichment *f* fastened in the center, as shown in section B. The panel is formed in one piece, with the enrichment *c* soldered or riveted at *d* and *e*. Suppose the panel were a large one, made of copper, and it was desired to save that portion of material shown by H, then laps could be allowed, as shown by the arrows, and *c* could be soldered down or riveted as shown by *d* and *e*. While this plan saves material, it does not make as good and strong a job, for the reason before mentioned.

In Fig. 126, A is the elevation of a foot molding in cornice work, in which the enrichment *e* is fastened, as shown in section B by *c*, in a similar manner as explained in connection with Fig. 126. The mold is formed in one piece, as shown by *a b* in Fig. 126 and *c* fastened at *v* and *t*. When band iron bracing is fastened to the molding, as shown, the bolt *x* must always be placed in position before the enrichment *c* is fastened. This applies to all moldings on which braces and enrichments are used.

CONSTRUCTING SEAMS TO AVOID SHOWING SOLDER.

The methods referred to by the title may seem very simple, but it is these simple methods which are often overlooked in practice where a second thought might have saved much time and labor. In Fig. 127, A represents the front view of a square panel into which the stamped rosette is to be fastened. The usual

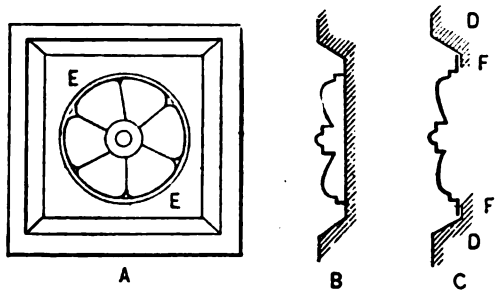


Fig 127. Fastening Rosettes on Copper Work

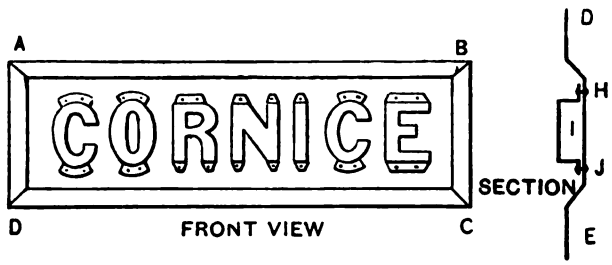


Fig. 131. Fastening Sheet Metal Letters in Panels

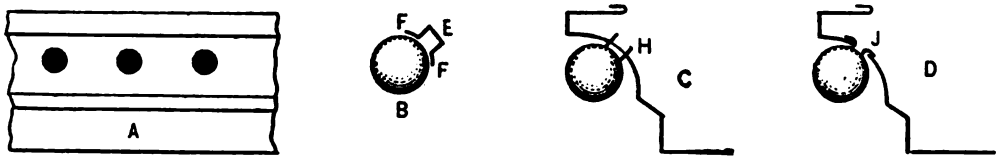


Fig. 130. Method of Fastening Ball

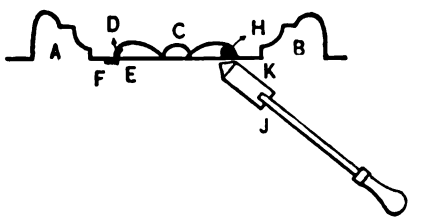


Fig. 128. Soldering Small Ornaments from the Inside

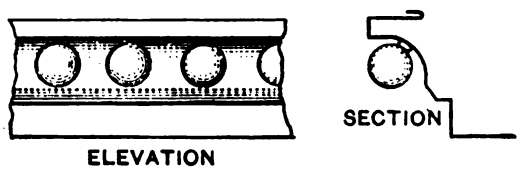


Fig. 129. Elevation and Section of Molding

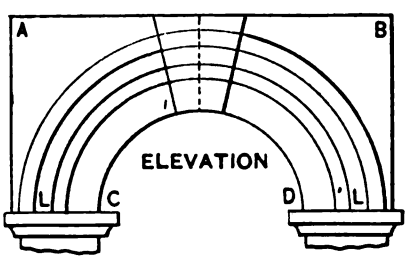
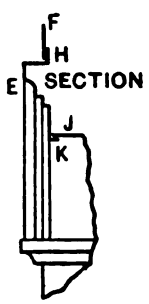


Fig. 132. Showing Arch Construction



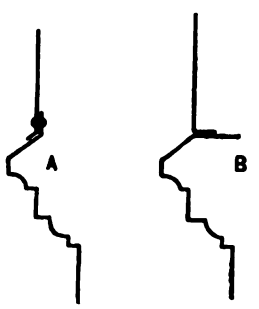


Fig. 133. Method of Joining Seam

method would be to form up the panel in one piece, as shown at B, and tack in the rosette from the outside. The proper method, however, is shown at C. Only the frame of the panel should be formed, as shown at D D, and the background

of the rosette, shown in diagram A by E E, should be stamped on to the rosette and soldered to the frame on the inside, as shown at F F. This gives a clean surface on the outside. It is often the case that rosettes are to be soldered in a long panel, where the background could not be pressed on it. There are two methods which can be employed shown in Fig. 128. A B represents the section of the panel and C the rosette. Flanges can be soldered to the inside of the rosette as indicated at D, and with a small, sharp chisel a slot may be cut into the panel ground, the flange inserted into it and bent over as shown at F. As many flanges should be put in as the size of the rosette requires. Another method would be to place the rosette in its proper position in the panel and scribe a line where the rosette is to come; then take away the rosette, tin it on the inside at various places and leave lumps of solder as shown at H. Tin the ground of the panel similarly and place the rosette in its proper position. Then by means of a hot soldering copper, J, tinned on one side and laid against the bottom of the panel K, the solder begins to flow and secures the rosette on the inside. Fig. 127 is an elevation and section of a Gothic molding having full rosettes or balls attached to the cove molding. The method of attaching balls of this kind is shown in Fig. 130. Let B represent the full ball, having a small tube, E, flanged out at F F and soldered firmly. A represents the molding, having holes cut into the cove with a hollow punch into which the tube E in diagram B should fit, as shown in diagram C.

Having placed the ball as in C, press it in firmly against the molding, and with the shears notch the tube H and turn the flanges over by means of a small hammer, as at J in diagram D.

It is sometimes the case that a sign is to be placed in the panel of a cornice. Fig. 131 shows the method of fastening metal letters in panels. Let A B C D represent the front view of the panel and D E the section. Flanges should be allowed on the side strips of the letters, and riveted from the inside by means of copper rivets, as shown in section by H I J. In Fig. 132, A B C D is the elevation of an arch or curved molding placed in a square background. The section of the arch is indicated by E and can be turned in the curved molding machine or pressed in one piece with a lap or flange at H and K. On the flange H the square background A B is placed and soldered from the inside. When soldering the return strip J to the bottom of the curved molding K it should be placed as shown at J K, having the return strip J on the inside of the flange and soldered on the inside. This gives a clean appearance when viewed from the front. At L L flanges are bent outward and soldered to the cap of the pilaster.

When joining seams on copper work on which no solder should show on the outside two methods are employed, the one as shown in diagram A in Fig. 133 by overlapping the flange and riveting, and the other by bending the two flanges inward as shown in diagram B, being careful to have the lower flange wider than the upper flange, as shown, so as to allow the soldering to be done from the top. When making copper finials for tops of dormers or towers it is sometimes necessary for the sake of economizing material to have a horizontal seam, as shown by A A in Fig. 134. When making the seams, and before cutting the pattern, care should be taken to have the seam come inside of the molding, as shown in Fig. 134. The seam A A could be soldered on the outside, and then covered with the molding,

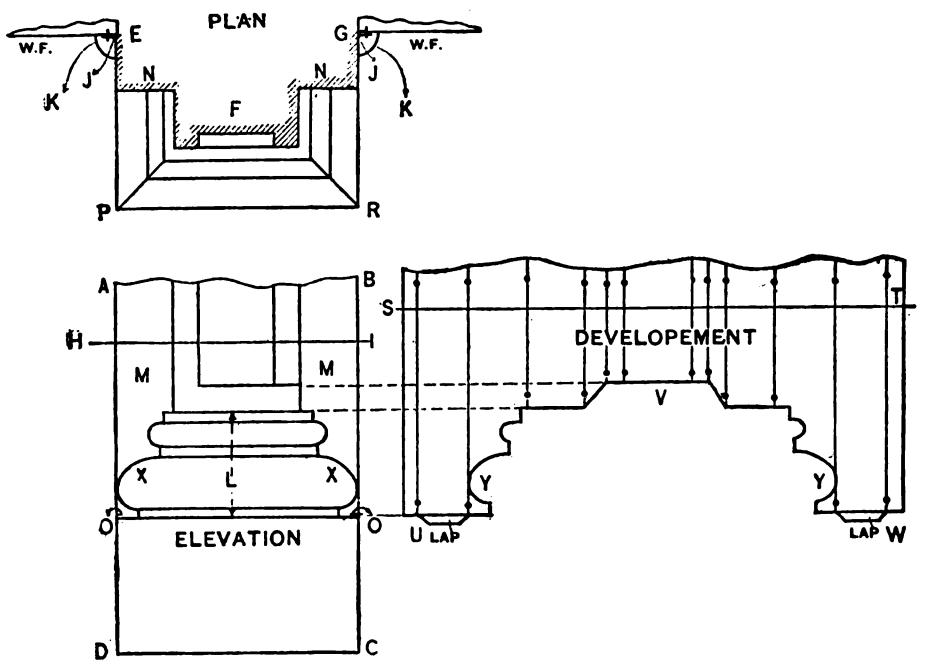


Fig. 135. Column of a Dormer

which is then only soldered around the top at B B. When soldering the upright seam of the finial it is sometimes difficult to solder the seam on the inside when the finial is very long. In this case, before rounding up the finial the seam is slightly bent, as in diagram C, and when rolled up it will look as in E, diagram D.

This allows it to be soldered on the outside where necessary and the seam scraped and sandpapered, thus giving a smooth surface and showing no joint.

In Fig. 135, A B C D is the column of a dormer window or similar piece of work. E F G shows the plan view taken on the line H I. A flange is bent outward on either side of the column at J and J in plan, which allows it to be nailed against the window frame indicated on either side by W F, and is then

covered by the wooden bead K. L represents the molding, with returns butting against the flat surface M. When getting out the pattern for the returns of the molding L and its base, the base shown by O D and O C in elevation returns back as far as shown by P E and R G in plan, while the molding shown in L returns as far as shown by P N and N R in plan. Where the sides of the column E N and G N in plan meet the side of the base shown by O C and D O in elevation a flange is bent inward, as shown at O in elevation, and soldered inside. To better illustrate how to lay out the pattern so that the seams between the column and its base can all be soldered inside and leave a perfectly clean outside appearance, let S T represent the stretchout of the column shown in plan by

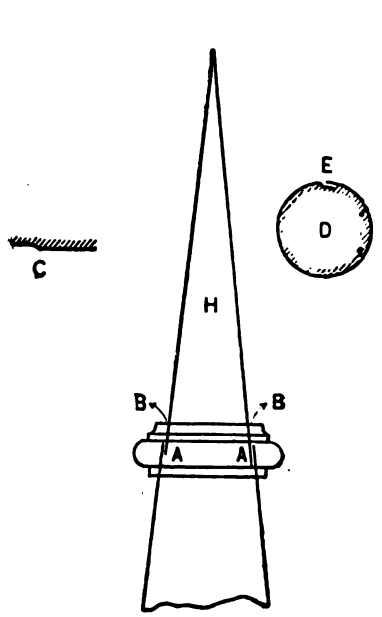


Fig. 134. Covering Seam on a Finial

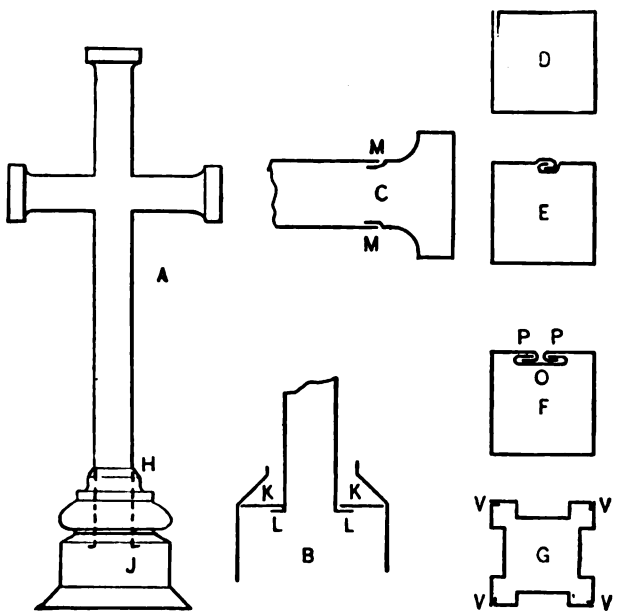


Fig. 136. Construction of Crosses

E F G. At right angles to the stretchout line draw lines which intersect with lines drawn from corresponding points in the elevation. Then will U V W show the cut for the pattern for column. V shows the panel miter in the column, Y and Y the profiles of the moldings X X, and against which the laps of the returns X X will be soldered on the inside of the column shown by N and N in plan, while U and W indicate the laps which are shown in elevation by O and and O. Using this method not a drop of solder should show on the outside.

Fig. 136 shows the different methods of constructing the seams on crosses, which are mostly made of 20-ounce cold rolled copper and are usually gilded with pure gold leaf. For this reason no buckles should show; all should be flat and smooth so as to reflect an even surface.

Let A represent the front view of a plain cross and its base. When joining the cross to its base it should never be soldered or joined to the base at H, but the lower arm should extend inward and be joined to a flat bottom at J. In diagram B this is more clearly shown. Let K K represent a flat bottom of heavy copper soldered to the base in the corners, as shown, with an opening cut in the center which allows the lower part of the cross to slip into it and be flanged and soldered as shown at L L. It is also soldered at H in diagram A and scraped to show a smooth surface. This method secures the base with the cross in firm manner.

Diagram C is a portion of one of the arms of the cross, and shows the method of attaching the heads. It will be noticed that where the head joins the arm, as at M M, the lap of the head is set off a little thus making a smooth surface on the outside when soldered, which is then scraped and sandpapered. When forming the shafts or arms of the cross the seams can be placed in different ways. D represents the seam placed at the corner and soldered from the outside and scraped. E is a grooved seam, which is not advisable when the cross is to be gilded, as a smooth surface must be obtained. The best method of the three is shown at F; this requires no soldering and gives a smooth surface. The edges P P are bent inward and are caught by the double lock O; then by means of a mallet the surface is hammered down smooth by placing a mandrel or square iron bar inside of the cross.

G represents the section of a cross having paneled sides, which necessitate the soldering of the upright seams at V V V and V, which must be scraped and sandpapered. When soldering copper work on the inside the acid is liable to soak through the seams. Hence, when the work is finished, rub over the outside joint with a rag on which a little oil has been placed, which keeps the copper from turning green. It often happens that some work must be soldered outside and then colored to copper color. To do so, obtain from a drug store about 10 cents' worth of sulphate of copper and dissolve in about ½ pint of water and apply it to the solder with a small brush, or another and better fluid can be made by obtaining copper bronze mixed with oil and applying it the same as paint.

SOME WESTERN METHODS OF CORNICE WORK

In this article an endeavor will be made to illustrate some of the simplest points about galvanized iron cornice constructions as practiced in the West, and show, perhaps, where some time may be saved by describing the different steps to

be taken, from the time the drawing is received from the architect to the setting of the cornice on the building ready for the mason to back up; in short, a disquisition invaluable owing to the dearth of literature on this subject.

There has been chosen for this purpose a plain, ordinary main cornice, with a head block on each end, as shown by Fig. 137. The first thing to do is to make a full size detail, if none be furnished, and place it on the drawing table in the lower left hand corner, so as to facilitate the drawing of the horizontal lines. About the first pattern cut on a cornice of this kind is the bracket side, which is marked (with muriatic acid in which some copper filings have been dissolved) with the number required, the 7 *m* in Fig. 139, meaning seven more, which, with the pattern, makes eight sides, the number required for four brackets, as called for in the elevations. The scroll in the side is a single cut of the snips. It will be observed that in addition to the ⅞-inch lap allowed to turn out for riveting purposes, there are two pair of prick marks on the outside edge, the use of which will be explained further on.

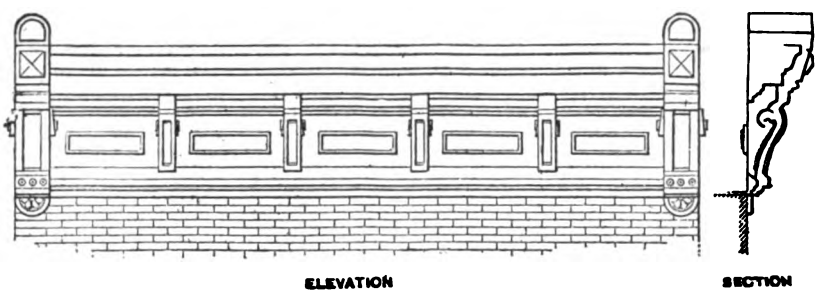


Fig. 137. Example of an Ordinary Cornice

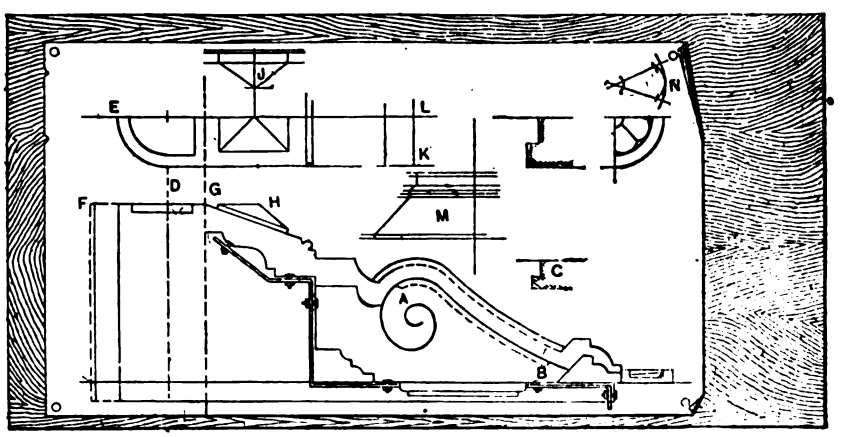


Fig. 138. Drawing the Patterns

Next take, with a strip of thin metal, the stretchout of the top part of the bracket face, from the top of the sink at A, Fig. 138, upward, allowing a ⅞-inch lap to turn out, to which the crown mold will be fastened. Transfer this stretchout to a piece of iron the width the brackets are to be, and mark it as before described 3 *m*, which will be four with the pattern, the number required. It is usual to use up the patterns, as it would be found a costly system to keep the patterns for all the cornices made, in this age of keen competition and variety of designs. The stretchout of the foot of the bracket is next taken from the point B downward, turning out ¼-inch on the wash of foot mold.

It is these little details of construction which count in putting the work together, the getting enough laps and edges to make a good job without getting in anything of the kind that will impede the putting together of the work. Next draw a half section of the face, as shown by C, Fig. 138, giving the depth of sink and width of strips on each side of it, the middle strips or back of sink being cut to the exact length called for on dotted lines, but ½ inch wider, for convenience in putting together. Now take the pattern of the side and laying it on a piece of iron scribe along its curved edge from one pair of prick marks to the other and put the marks in. Cut out along this line, then with a gauge made of sheet iron the depth of the sink, as shown at G, Fig. 139, mark off the pattern and cut off ends through prick marks, which gives the right length. There are no edges or laps on these strips, the different pieces being soldered together sharp.

The head block will be treated in the same way, only the pattern for the side that goes on the outside will run back 2 inches over the wall line with a 1-inch edge

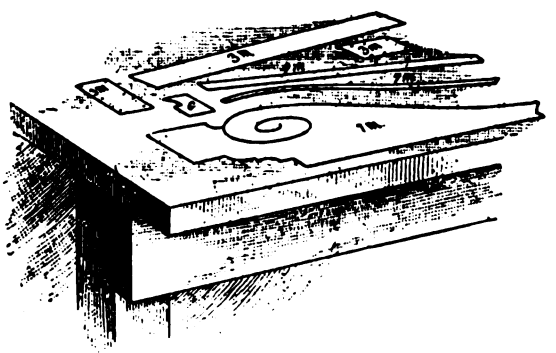


Fig. 139. Patterns for Bracket

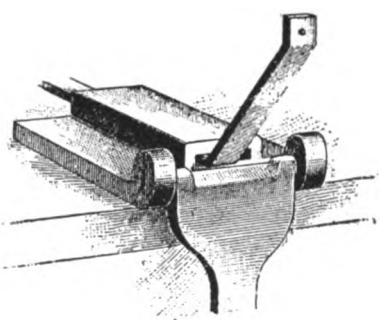


Fig. 140. Anchor Bending Device

turning in, while the side butting the cornice will be cut to fit moldings of cornices with edges left to turn over same. It will be readily seen from an inspection of the drawing, Fig. 138, that the stretchout is taken of the top part of head block from the spring line D to center line E, which is laid off in its proper place on side of head block, and a lap allowed where the sides will meet on top, all as shown by F. From the line G downward a stretchout of face down to top of sink is laid off giving a true face of the part that takes the raised panel H, the pattern for one-quarter of which is shown also at J.

Take the pattern for this part of the front off the paper in this way, slide a piece of iron large enough for the whole pattern under the paper, feeling its position from the outside of the paper, bring one edge about parallel with the line D K, and put in the necessary prick marks for bending, and one mark each at E and L on center line. Turn the iron over, bringing the reverse side of the prick marks

at E and L (which can be plainly felt as the iron is being slid around under the paper) to their respective places, and repeat the pricking process, giving the whole pattern. It takes longer to describe this than it does to do it, and it has the advantage of not only saving time and space in the making of the drawing, but it is very accurate as well. The panel head M is taken off in the same way, where its advantages are still more apparent. The sinks in the face at top and bottom of head block are cut in, the piece falling out making the back. The strip used for sink is straight with one edge on it turned in, so that where the before-mentioned back is dropped in, it will lay on it and be tacked there. The pattern for flutes in base of head block is shown at N.

The molding is the next thing to get out, and as there are no miters in the cornice take the stretchout with a strip of thin metal. The crown mold runs down

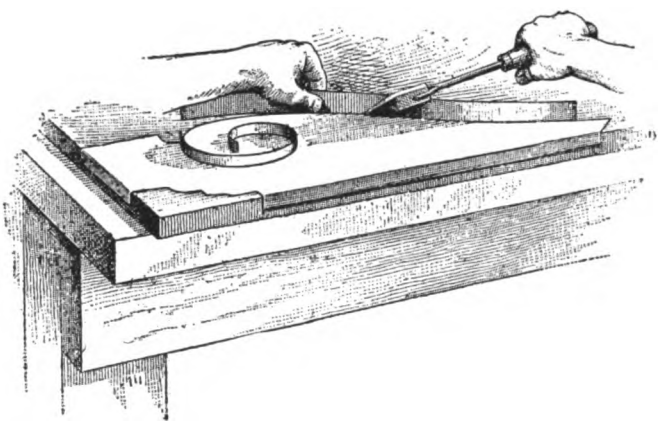


Fig. 141. Soldering Strip on Outside Edge of Bracket

to the face of the brackets usually, but sometimes the crown and bed are made all in one; this, of course, depends on whether the stock cuts to good advantage that way or not. The body of the panel is usually cut all in one, but this also depends on the size of it, and is cut by using the panel head for the four miters, the distance between the panel moldings being the length of the head itself. The anchors come next and are made of $\frac{1}{4} \times 1\frac{1}{2}$-inch band iron, and are fastened to the cornice with $\frac{1}{4} \times \frac{3}{4}$-inch flat head stove bolts. For the pattern take a strip of metal and obtain the stretchout, indicating where a bend is to be made by a line drawn across it, and where holes ought to come by a dot of the marking stick. The anchors, after being punched, are bent to shape in the vise or by a contrivance fastened to the bench, as shown in Fig. 140, and which is made of cast iron.

The next thing to turn attention to is the putting together of the various parts, and the bracket side comes first, as before. Put a $\frac{1}{2}$-inch strip around the scroll,

starting at the terminus of the scroll and cutting off when it comes to the face of the bracket. This strip is soldered on the inside of the bracket side and on the side of cut furthest from wall line of bracket at the starting point, which will allow the scroll to be pulled out when the bracket is together, showing the volute shown in the elevation. This strip is held while being soldered by the forefinger and thumb of the left hand, in the same way as shown for the strip on the outside edge in Fig. 141. Instead of tacking about every inch, as is often done, and then going over it the second time to solder through, solder right through in the first place by drawing the tack along until it meets that already done.

The strip on the outside edge is next put on, as shown in Fig. 141, and right here is where those prick marks save time, as this strip is started from the lower pair on one set of sides and from the upper pair on the other set. Next the sink

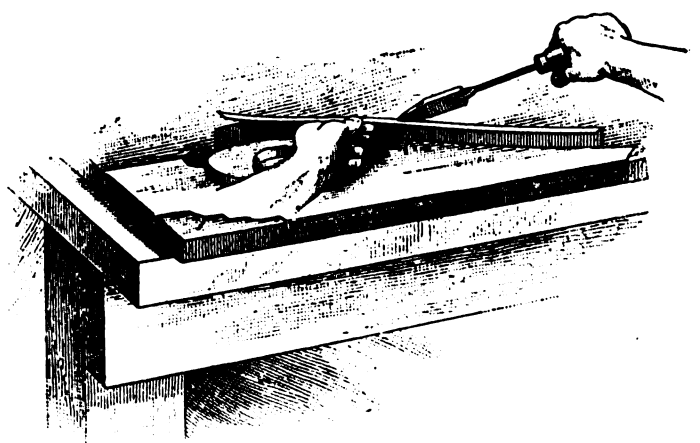


Fig. 142. Soldering on Sink Strip

strip is put on, as shown in Fig. 142, by putting the acid on the inside and soldering from the outside, the solder soaking through and taking a firm hold. These are done in pairs, of course, and after putting the head and foot on one side and soldering fast, the bracket is ready to be put together, which is done by laying the side with head and foot attached flat on the slab and laying the opposite side on top, soldering from the outside as before described. This finished, the bracket is turned up and the back of sink is pressed up against the sink strips and soldered fast. Care should be taken that the work is true, as this piece makes the bracket rigid. When the molding is formed and put together to the right length, and the panels made up, the sections are ready for assembling. The brackets are spaced off as called for on the elevation and soldered to the bed mold, then the crown and foot are put on, and the panels are dropped in and tacked; finally the whole is riveted off with small rivets headed up on the inside. The anchors are put on

about four feet apart and placed so they do not interfere with the panels; that is, they are set near the brackets clear of the panels. This done and the cornice is ready for the building, and is set on the wall, as shown by the section, Fig. 137, and also by the inside or back view of cornice, Fig. 143. Wires are tied to the

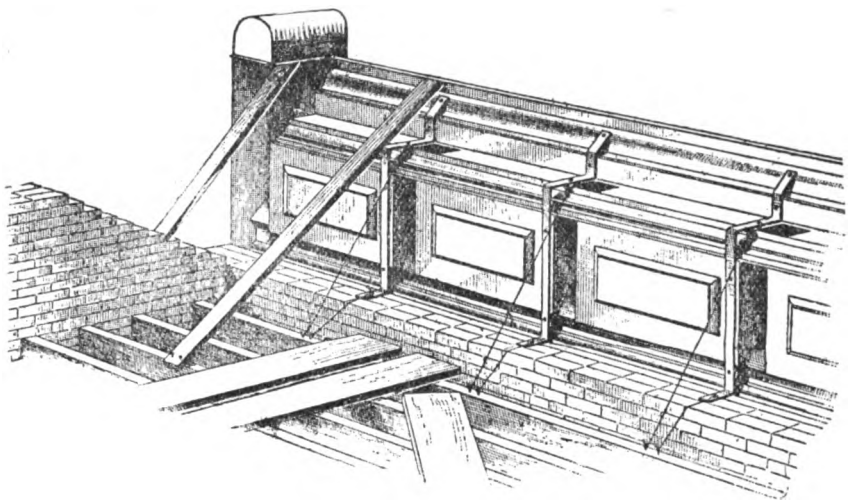


Fig. 143. Back View of Cornice

anchors at convenient points and a spike tied to the wire and driven into any stationary timbers that are handy, such as roof joists or ceiling joists. This mode of fastening allows the cornice to be drawn to proper position and held there by the help of a few braces of wood, all as shown in Fig. 143.

ASSEMBLING A LARGE COPPER CORNICE

In the following it will be endeavored to exemplify the method of assembling a large crimped copper cornice, as practiced in one of the leading shops of New York City. It is a system calculated to reduce to a minimum the number of times parts of a cornice are handled; hence a saving of time and energy. Though not an exact duplicate of the cornice as made, this description is based on a recent job.

A section of the cornice is given in Fig. 144. As will be seen, horizontal joints are necessary owing to the sheets, as obtainable, not being of sufficient width to take the entire girth of the cornice. By this method of joining, foot mold A, frieze B, bed mold C and the crown mold at the top of the cornice, are formed on the brake separately and joined by locks 1, 2, 3 and 4. The sheet shown in the part plan, fills in the space of the planceer, between the modillions represented by

I. This sheet is formed as shown by Fig. 156, and is riveted to the modillions as indicated by the large section on A-B in Fig. 144, slipped into pocket 4 of the crown mold and clinched to bed mold at 3. To stiffen the cornice and to provide means of fastening cornice to structural steel lookouts of the building, band iron braces are formed as shown by J and secured to cornice by brass bolts Z Z Z, better illustrated by the large section. The dentils are indicated by G, the stamped modillions by I and the stamped enrichment by F and H.

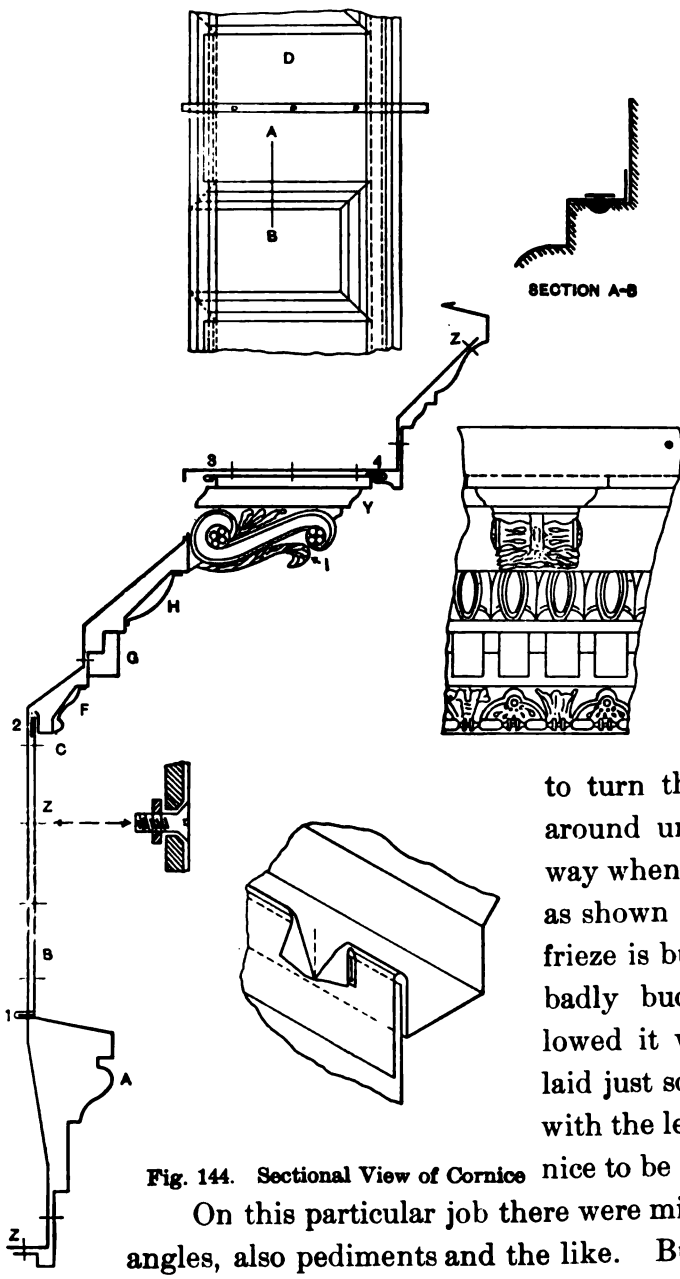


Fig. 144. Sectional View of Cornice

It will be noted in making seams, etc., the moldings are placed on the bench as they go on the cornice. For instance, if when the foot mold and frieze are being put together they are resting on the bench with the foot mold on the other side of the bench than as shown in the drawing, it would be necessary to turn the 16-ft. length of foot and frieze around until it faced the cornice the right way when being mounted on rest of cornice as shown in Fig. 158. Furthermore, as the frieze is but two flat sheets it is likely to be badly buckled. If the drawings are followed it will be seen how every piece is laid just so it will go in its respective place with the least handling and allowing the cornice to be assembled in an orderly sequence.

On this particular job there were miters, in and outside and at various angles, also pediments and the like. But as the general scheme of assembling was followed for all, the assembling of a 16-ft. straight section will be employed as an example. For as sheets of copper are usually available only in 8-ft. lengths, this gives one vertical seam or joint to a 16-ft. section or length to be

made in the shop, the other vertical seams are made after the cornice is in place on the building. If the length was to miter with another length, the process of assembling would not differ, for instead of the length having straight ends, it would have a miter cut at one end; the miter being made after the two lengths are set in place on the wall. Of course, with a self-return or a very short miter piece, the miter would be made in the shop on each horizontal section successively and after the seam of the two 8-ft. pieces were made as per the following and before general assembling.

Formerly modillions were stamped without the cap mold Y, Fig. 144, and caps in consequence were made on the brake, but now caps come integral to the sides

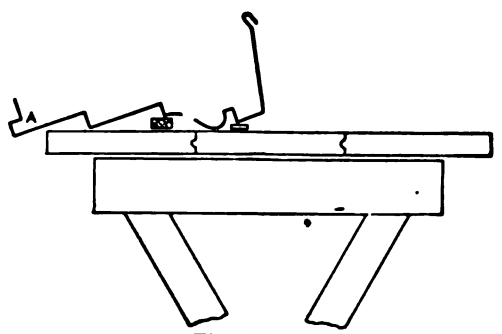


Fig. 145

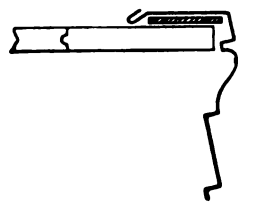


Fig. 146

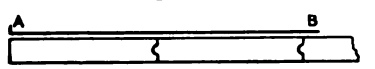


Fig. 147

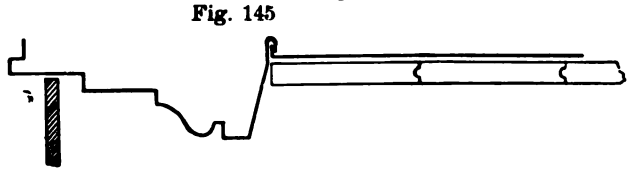


Fig. 148

Fig. 149

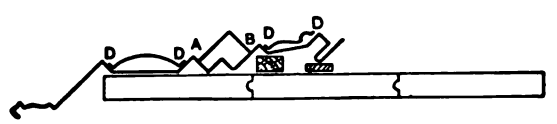


Fig. 150

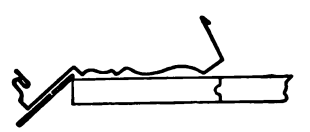


Fig. 151

Putting Together Straight Lengths and Assembling Various Parts

and one part of the front of the modillion, the front being in four parts, so the parts of the modillions need only to be soldered together, for all small parts of the cornice are prepared first; dentils made, braces cut, punched, drilled and formed, etc. Stamped enrichments F and H need no preliminary work.

Having completed this preliminary work, the building of the cornice is in order as follows: Sections A, B, C, D and crown mold having come from the brake they are stood on end in an accessible part of the assembling room; two sections of A are taken and laid on the bench as in Fig. 145, lapping them 1 inch. They are sighted by going to one end of the bench and looking along each bend, pulling the

near end this way or that and blocking up at the ends and seam until satisfied both sections are in line. Experience soon enables a mechanic to sight his work so it will be absolutely straight without the aid of a chalk line. Soldering is all on the

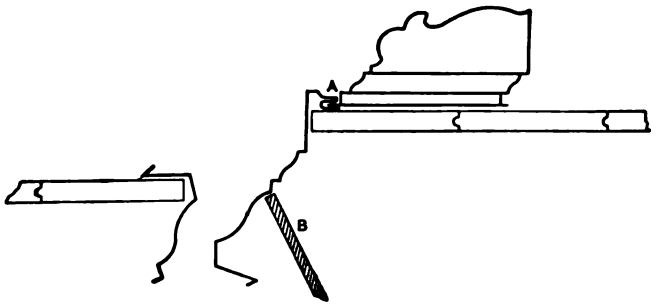


Fig. 152

Fig. 153

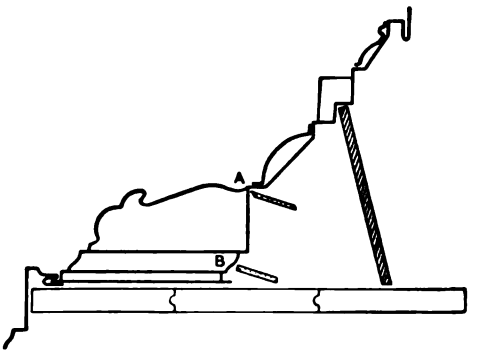


Fig. 154

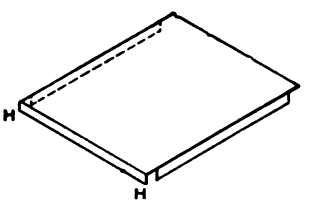


Fig. 156

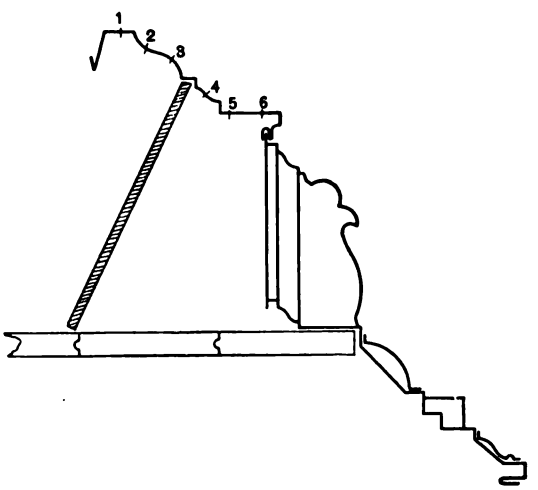


Fig. 155

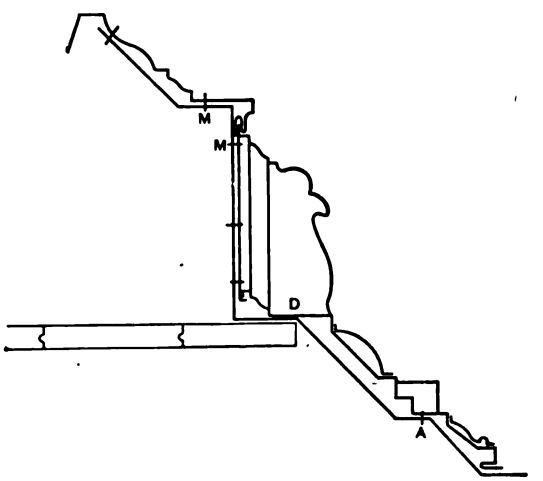


Fig. 157

Successive Operations of Assembling the Parts

inside and it matters little where it is begun—at the drip A, Fig. 145, usually. The molding is turned when this soldering is done, as shown in Fig. 146, and sighted, then soldered; then section A is laid on the floor, out of the way.

It is customary to double up two men on this class of work, and while one man is making seam just mentioned, the other is making seam of frieze B in this fashion: Two sections are laid on the bench as in Fig. 147, and are sighted, then tacked at A; again sighting—for this length must surely be straight—it is tacked every 3 or 4 inches, beginning at A, till the buckle is worked out at the edge B. During this operation it is well to place the blade of a steel square or a thin piece of band iron under the seam. By tacking is meant, soldering for a space of about ½ inch. The two men should have their seams finished about the same time and the first man takes the length of mold A and holding it as shown by Fig. 148, the other man, starting at one end, notches and folds the lock as indicated by the full size isometric drawing of lock 2, Fig. 144. These notches are spaced apart about one foot and by this little scheme no soldering is necessary, the lock holding as firmly as if riveted.

This part of the cornice is put to one side, and the two men working together from now on, take two sections of C and place them as shown by Fig. 149, and make seam as with A. After soldering, this length is flopped over by the two men grasping it at the small ogee sticking over the bench, not at the ends, but about three feet from the ends, for the length is flimsy and would be apt to buckle in the center if the men are not careful and hold too far away from the center. The length now having the position indicated by Fig. 150 the dentils G of Fig. 144 are soldered on at A and B of Fig. 150, spaced according to the part elevation of Fig. 144. The stamping F and H of Fig. 144 are also attached by tacking at D D D D of Fig. 150, with tacks about 3 inches long. This stamping comes in about 3-ft. lengths, and after tacking the stamping in place, beginning at an end of the length of molding of Fig. 150, it is found that the last length of stamping projects considerably beyond the end of the molding, a mark is made on the stamping coinciding with the end of the molding; the length of stamping is then removed and on the following length of molding it is tacked temporarily to the mark on it, the balance of the stamping tacked in place and the marked length removed, sent to the building to be soldered in place after the vertical seam of the cornice is made. This does away with the need of cutting off, stamping at the end of the lengths of molding, for it would not do to let it project; and insures registering, in respect to the designs of the length of stamping immediately following. This is all to be done with C just now and it is laid on the floor.

The crown mold seam is made as per Figs. 151 and 152 and then the crown mold is caused to assume the position in Fig. 153, propping it with a stick from the floor. The required number of modillions are slipped into the crown mold

pocket at A, Fig. 153, accurately spaced and tacked at A on each corner and the center. The next operation is to set the bed mold C, Fig. 154, and support with a stick. With a file or stick, one man pushes against the molding at B and the other man solders the miter of the cap molding of the modillion throughout to the molding. Then while the first man pushes at A, the other man solders the modillion to the molding along A. The props are now removed and this part of the cornice tilted over until it rests on the other side of the bench and supported with props made of sticks of wood, all as shown by Fig. 155. This position allows access to both sides of the planceer, and the planceer pieces, Fig. 156, are slipped into the crown mold pocket 4, Fig. 144, and the corners H and H, Fig. 156, clinched to the bed mold with pliers. Two rivets secure this to the pocket and three or four rivets as indicated by the large section Fig. 144, bind same to the modillions; the lock at the bed mold is finished later, as the cornice, in an upright position. The crown mold is now riveted as shown by line 1, 2, etc., of Fig. 155.

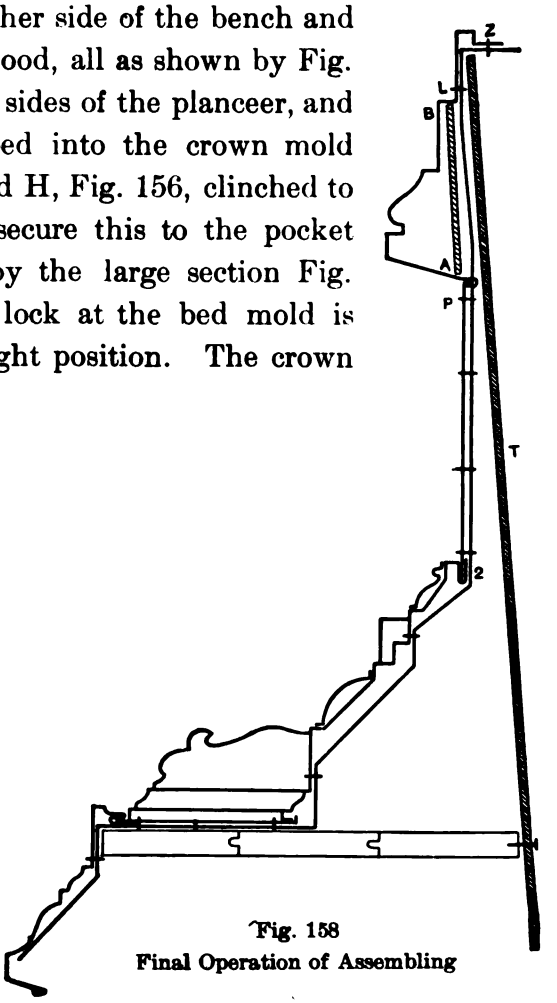


Fig. 158
Final Operation of Assembling

From the customary layout plan of the job, the spacing of the braces is noted and marked on the cornice with wax crayon; and one man raises an end of the partially completed cornice of Fig. 155, sufficiently high to permit the other man to slide the required number of braces in the places called for by the crayon mark, steadying these braces, calling for help if necessary, until the man holding up the cornice has lowered it to the bench, the weight of the cornice keeping the braces as they belong. The cornice being in the position of Fig. 157 and securely held by sticks and some wire, bolting to this much of the cornice can proceed by beginning at A (between the dentils, of course) and omitting bolt D. Extreme care must be exercised in placing bolts M and M, for if these are incorrectly placed, drip of the crown mold is thrown out of line. Bringing the cornice back to the position of Fig. 154 and nailing three boards as shown by Fig. 158, one at each end and one in the center, the frieze and foot mold can now be set. This part is lifted bodily into

the braces and bolted to the same at the foot mold drip Z, Fig. 158, the frieze forced into the lock 2, Fig. 158, and the locks notched, folded and dressed down as per the isometric, Fig. 144. Bolts L of Fig. 158 are placed, being careful to keep the drip in line. For bolts P a gauge A B equal to that space of the full size detail drawing is employed as a guide. The remaining bolts are put in, not forgetting the omitted one at D of Fig. 157, and the seams of the bed mold, frieze and foot mold riveted.

Before taking from the bench the cornice is carefully cleaned with a moist, then a dry rag, rubbed over with a rag saturated with linseed oil and all solder showing bronzed. The cornice is taken from the bench, stood on the drip of the foot molding and the clinching of the planceer pieces at lock 3 of Fig. 144 completed as per the isometric of Fig. 144. This being the final operation for the shop work, the completed section of cornice is placed in some out of the way part of the shop, awaiting shipping to the building.

A SHEET METAL ROOF BALUSTRADE

On many buildings an additional ornamentation to the cornice for the roof line of the structure is placed above the crown of the cornice, such as pediments, balustrades and the like. While there are many methods of constructing these sheet metal balustrades, it does not seem amiss, owing to there having been little or nothing printed pertaining to this work, to present the scheme of procedure by which hundreds of these roof ornaments are made and set.

According to strict custom, relative to architecture, the balustrade should be placed on the wall line of the building, but as the houses are usually built in crowded sections, little opportunity is given to view these from afar; naturally then to be seen at all they must be near the edge of the roof; and for the same reason the bottom rail, or rather the base of the pilaster, is made deep to raise it to the line of vision from a point as near as the opposite sidewalk.

While many designs are possible, it is not attempted to make this a treatise on design, simply to exemplify the manner of assembling and erecting. Therefore the matter of design will be passed over except to state that the baluster or posts A, Fig. 159, are spun; also the ball, and that if preferred an urn may be substituted for the ball. Note the narrow circular strip D, Fig. 159, to facilitate soldering to the pilaster.

As stated, posts are spun, that is, with the exception of parts B B, which are bent on the brake. These are in one piece with a seam at A, Fig. 160, and are

formed by bending on the corner lines as B B B, and unbending, which leaves a crease; then the soldering flange E is bent and also the top. As the corners are creased they can easily be rebent with the fingers, after which the seam is soldered, likewise the miter C, of the top, being careful to keep the box square and not twisted. The spun parts are now soldered to these boxes on the part C, care being exercised to keep the top and bottom boxes in line with one another.

The pilasters C of Fig. 159 have three sides molded and a flat back, and consist of three parts—base, center and crown. The center piece is generally paneled in the front and sometimes the side, where there are no posts, as in the

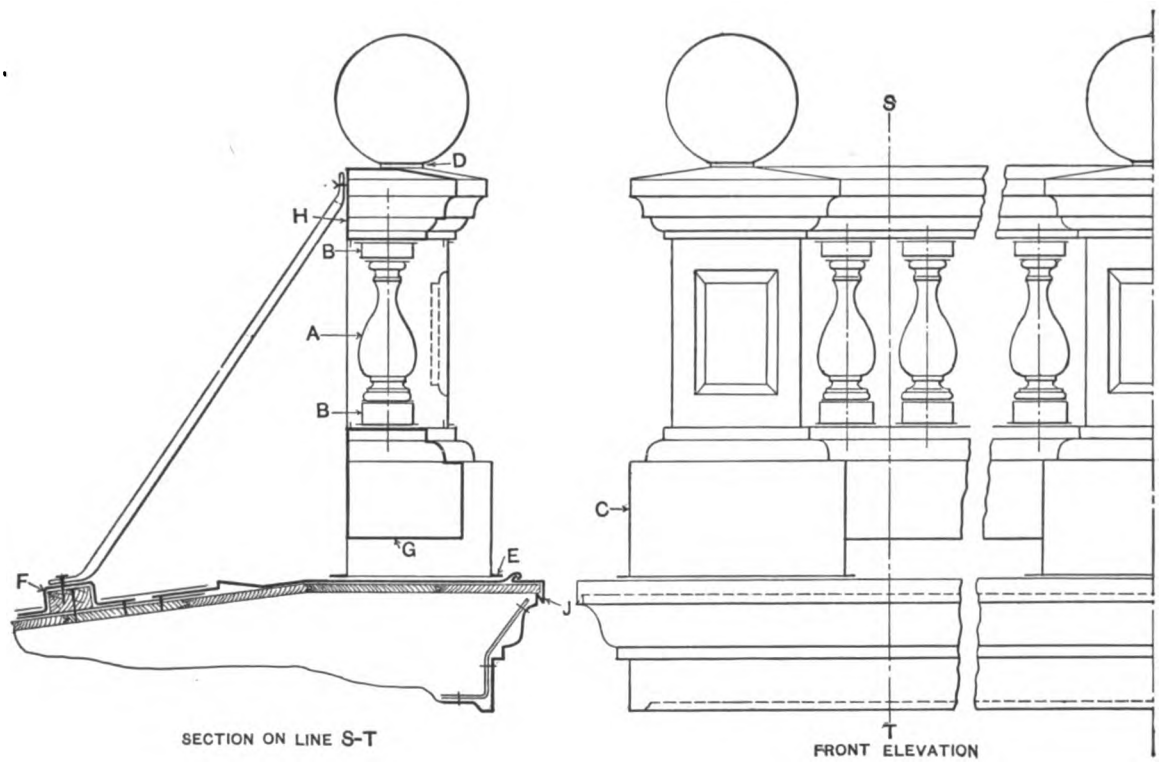


Fig. 159. Elevation and Section of a Sheet Metal Roof Line Balustrade

end pilasters.. When making these pilasters the base and crown are put together complete. The center piece has the two sides and back blank and in one piece, and the paneled front is locked to this as shown by Fig. 161, tacking with solder at A. If there are two paneled sides, they are made separate, to allow soldering together the miter of the panel without having the other side attached, which makes the operation of soldering awkward, more so if the panel was elaborate and of copper. The center piece is now placed on the crown and soldered at A, Fig. 162. When doing this the crown is inverted, therefore reverse and set crown and

center piece on the base and solder, same as for the crown. Of course riveting would add strength to the joint. The joints between the base and center piece and between the center piece and the crown, at the back are like B of Fig. 162. The joint, of course is on the inside of the work. The ball is soldered to the pilaster after the balustrade is erected, to obviate the possibility of bruising the ball when hoisting the pilaster.

These pilasters are set on the roof and soldered to the roof on the flanges E, Fig. 159. They are braced by a sheet metal tube reinforced by a 2×4-in. joist; the ends of this tube are flattened and one end nailed and soldered to a block F, Fig. 159, which was previously secured and flashed to the roof; the other end is wired and soldered to the top of the pilaster. No doubt wrought iron braces would be better, still this is the scheme usually employed. The roof is framed level for the balustrade, and if roof is covered with tar and gravel, that part under the balustrade is covered with sheet metal as shown.

It does not seem that this method is objectionable, even though it is expeditious,

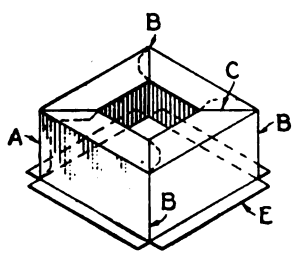


Fig. 160

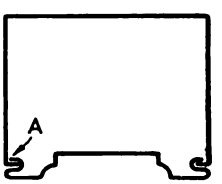


Fig. 161

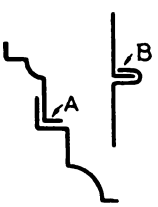


Fig. 162

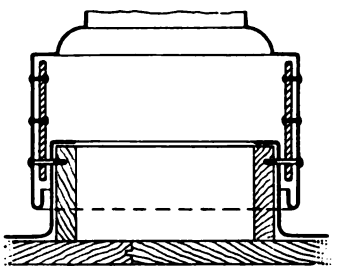


Fig. 163

Details of Forming Parts of Sheet Metal Balustrade

and a suggestion is that pilasters be set as carpenters place wood railings on porch roofs, that is, nail to the roof-boards four boards to fit inside the base of the pilaster and flash as illustrated by Fig. 163.

Evidently the story is wandering from its right trend, for the rails with the balusters, or posts, are forgotten. So back we must go to the shop to see how they are assembled. They are formed as shown by the heavy lines in section of Fig. 159, with inside miters to fit on the pilaster and of a length from pilaster to pilaster. The bottom piece G, of the rail and the back H, Fig. 159, are separate and held by a lock similar to Fig. 161. Leaving these parts off, the top rail is placed upside down on a board nailed to the bench on supports, to have all the weight on the part where the posts are soldered, the intention being to have a solid backing for the soldering. These posts are spaced as required, and after soldering all to the top rail it is removed from the board and bench and the bottom rail placed on the board and the top with the appended parts brought back to the bench and raised

up on to bottom rail, inverting it while doing this, for it was upside down. The posts are then soldered to the bottom rail, watching closely so that the space between posts at the top rail is maintained at the bottom.

It is now lifted bodily from the board, laid face down on the bench, and parts G and H are attached. On the building it is slipped between the pilaster, and the miters are soldered.

The principal reason for having the bottom rail above the roof is to allow the painters and kindred mechanics to place their roof irons for the scaffolding without punching a hole in the rail. Then again it saves material, as very little of the rail can be seen from the street.

Attention is called to the drip in the crown of the cornice at J, Fig. 159. This is a commendable idea, as it prevents soiling of the crown by the drip of water from the roof.

SHEET METAL FRONTS FOR BUILDINGS

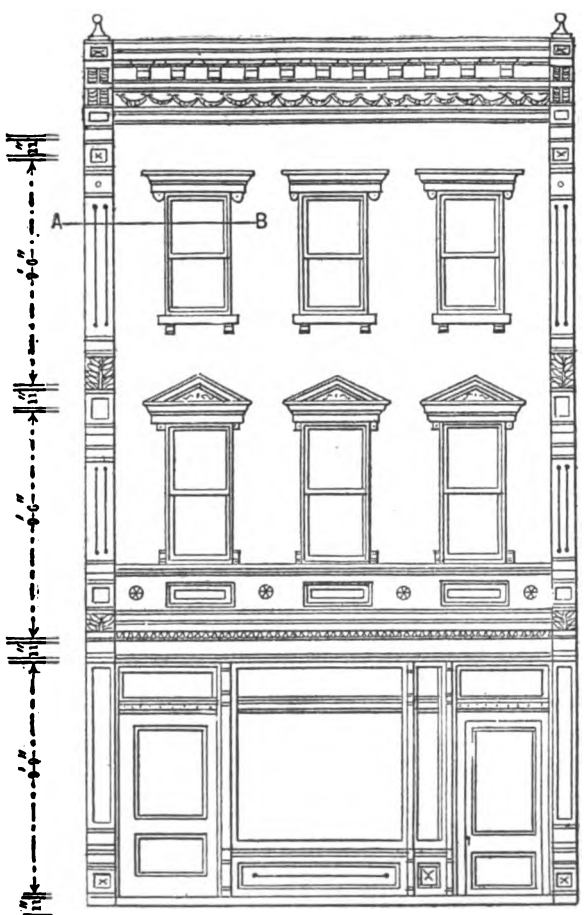


Fig. 164. Plain Front, with Store on Main Floor

Referring to the engravings, Fig. 164 represents the design for a front having end stiles extending the entire hight of the building with modillion cornice, plain caps and sills; Fig. 165 shows a similar front with belt courses, modillion and bracket cornices, while Fig. 166 shows a front having double show windows in the first story and double bay windows extending through the second and third stories. In Fig. 167 is represented a front elevation in which the store is omitted and a square bay window substituted, the sill and lintel courses running the entire width of the building. When putting up these fronts the sill course on the walk line is usually made of oak, and on this the framing of the front is carried upward by means of joists, over which the front is sheathed. Care should be taken to have the carpenter use throughly dried sheathing,

for if green stuff is employed to which to fasten the metal the heat of the sun shrinking the wood will cause the metal to buckle and spoil the effect of the entire front.

In the matter of sweating, or condensation, a word may not be out of place here. There will be no condensation if siding is applied to old brick walls, because the heat from the inside of the building cannot penetrate the wall, and the temperature is the same behind the siding as on the outside, therefore causing no condensation. On the other hand, the frame buildings are not brick filled, probably only covered with wood sheathing, on to which the metal siding is nailed. The heat from the inside of the building, penetrating through the wood sheathing and rosin sized paper, comes in contact with the cold surface of the metal, thereby causing condensation, with the results as stated. In putting on metal sidings on frame buildings, let the carpenter nail the rosin sized paper on to the upright joists, and over this nail on the wooden sheathing. On top of the wooden sheathing have upright wooden strips, $1\frac{1}{2} \times 1\frac{1}{2}$ inches, nailed, spacing them four to each length of the sheet of siding and being careful that the wooden strips will meet the cross seam on to which the siding will be nailed. This gives an air space of $1\frac{1}{2}$ inches between the back side of the metal siding and the wooden sheathing. At the top, below the cornice or gutter, have $\frac{3}{4}$-inch perforations punched in the siding, 6 inches apart, and at the bottom above the base have the same size and number of holes. By having these perforations at the top and bottom, a draft is created in the $1\frac{1}{2}$-inch air space, thereby giving the same temperature behind the siding as on the outside. Metal siding should always receive a good coat of metallic paint on the back before being put on.

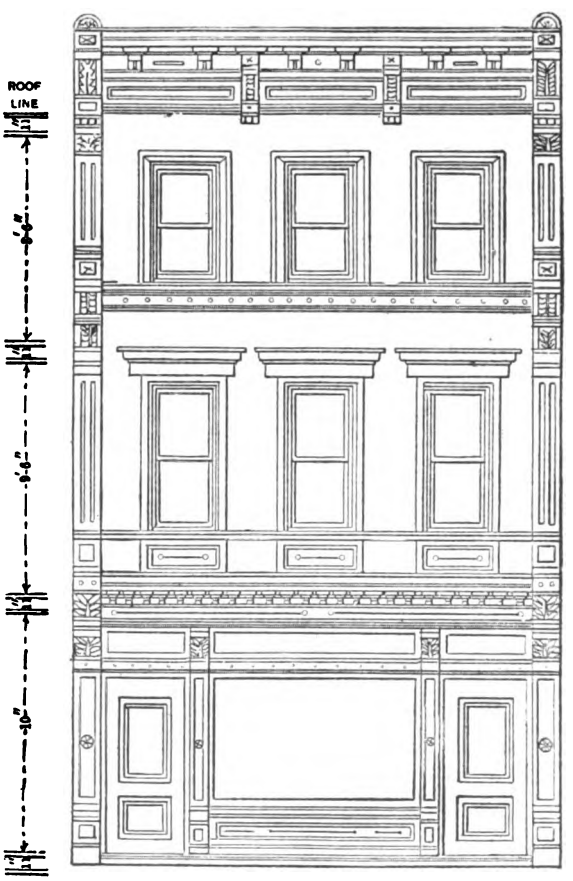


Fig. 165. Front Having Belt Courses and Modillion and Bracket Cornices

The front elevations shown herewith are drawn to a scale of $\frac{1}{8}$-inch to the foot; when drawing the sections enlarge

the elevations to ¼-inch scale, and from the lines in elevation construct the section at pleasure giving the proper projection to keep the work in proportion, making the profiles to suit the molds in the cornice brake. The stamped work can be bought of any dealer in ornaments. Should the front be desired in brick or rock face, sheets pressed to the desired design can be obtained from different manufacturers.

It is usually the custom to make the first story stile of wood as high as the show window line, and from that point upward of metal. However, if all the fronts above the wooden sills shown on the elevations are to be of metal, the first story stiles should be constructed of No. 22 galvanized iron, the corners well riveted to withstand the rough usage at the bottom. In the same manner the window sill should be made of heavy material, while the other parts of the front could be made of Nos. 26 to 24 galvanized iron, painted with a coat of metallic paint before applying against the sheathing.

In Fig. 168 is shown a water tight joint between the wooden store front and

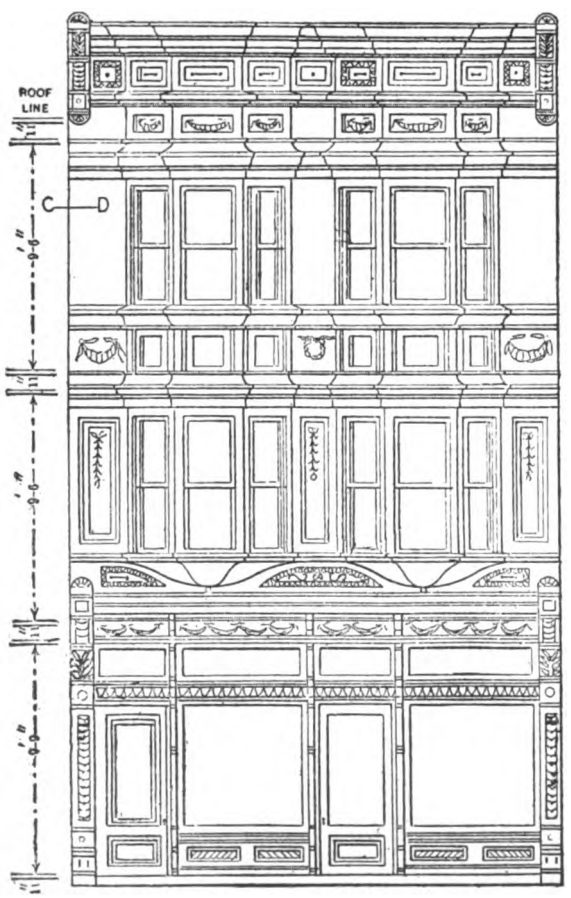


Fig. 166. Front With Double Show Windows

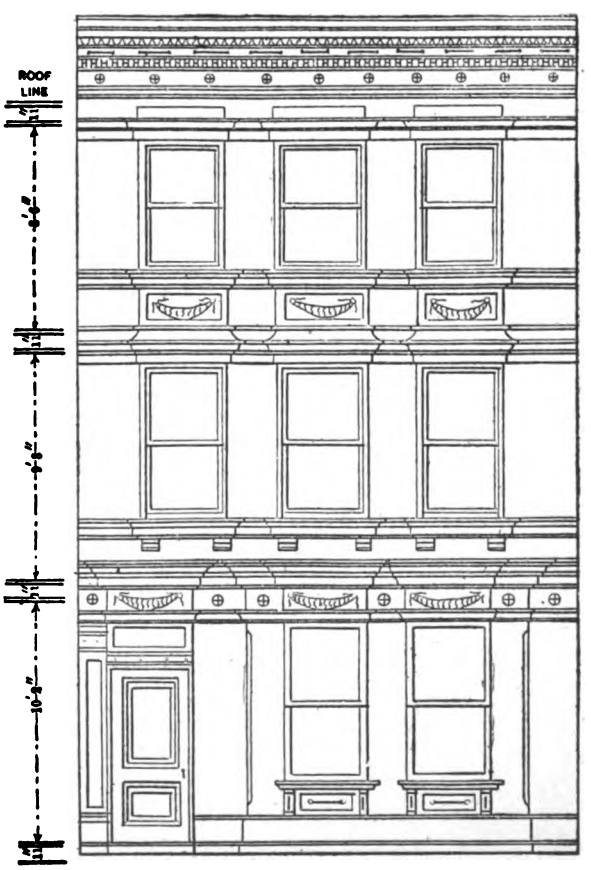


Fig. 167. Three-Story Front Without Store

metal store cornice. A shows a section of the show window frame and B the glass; C shows part of the store cornice, with a drip; E, the flange extending on the frame at D and nailed. The water dripping downward passes over the show window, and cannot get into the joint at D. In Fig. 169 is shown a tight joint between the metal roof of store cornice and metal front. A shows part of the store cornice with wood sheathing at D, while E and F represent the studding and sheathing respectively. B shows the galvanized roof covering flashed up against the sheathing at C, while H shows the metal front flanged out at the roof line at J, which is soldered onto the metal roof.

In Fig. 171 is shown the method of obtaining tight joints between the metal sill and wooden window sill and metal front. A shows the wood sill and B the

Fig. 168

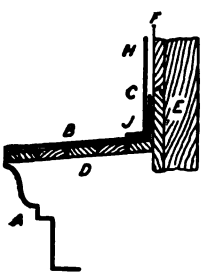


Fig. 169

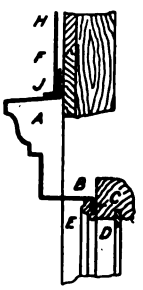


Fig. 170

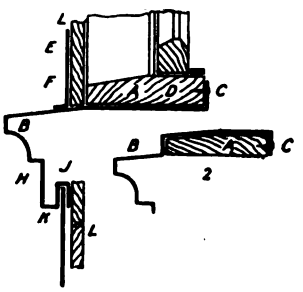


Fig. 171

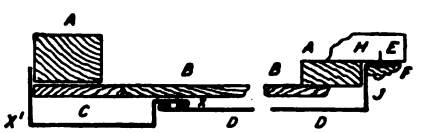


Fig. 172

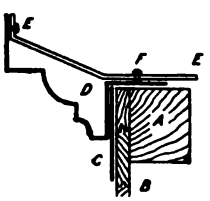


Fig. 173

Methods of Making Joints

metal sill, flanging backward behind the wooden sill at C and nailed at D, while E shows the metal front flanging outward onto the metal sill at F and there soldered. H shows the drip, which is bent onto the metal sill, having groove bent as shown at J, into which the lower part of the front K slips, as shown. L and L represent the sheathing.

In the same figure in Diagram 2 is shown the method of covering the top of the sill. A shows the wood sill, B the metal sill covering the wood sill and nailed as shown at C.

In Fig. 170 is shown the joint between the metal window cap and wooden window frame and metal front. A shows the window lintel, running back against the window frame C, and nailed through the flange B at D, after which the joint is hidden by the wood mold E nailed to the window frame. The top of the lintel

extends up against the sheathing, as shown at F, and over which the metal front H is flanged and soldered at J. In Fig. 173 is shown the joint between the metal front and main metal cornice. A shows the top horizontal studding and B the sheathing, C shows the metal front over which the drip D of the main cornice is set, as shown; the main cornice being fastened by the iron braces or lookouts E E with bolts at F. Fig. 172 is a horizontal section through A B of Fig. 164, and C D of Fig. 166, showing the joint between the metal front and upright metal stile and wooden window frame. Let A A be the studding and B B the sheathing. C shows the metal stile flanged against the studding A, and against the sheathing B with a water lock at X, while D D shows the metal front with an edge bent on same where it butts against the stile C, so as to remove the buckles; at the window side it is flanged against the window frame E, nailing the metal flange F at H and covering the joint by the wood mold J. Where the metal front has no stile as at C D of Fig. 166, it is made similar to the corner X^1 of the stile C of Fig. 172. In putting a large surface on a front, it is well to have it crimped to avoid buckles. The methods shown in Figs. 165 to 173 are those which are usually employed when flat iron is used; where stamped plates are employed, directions for putting up are furnished with them.

PRACTICAL CONSTRUCTION OF A SHEET METAL CORNICE—I

In the following article will be described the practical methods to be employed in cornice construction from the time the blue print is received from the architect to the setting and covering of the cornice at the building. The methods will be explained of detailing the cornice, laying out the patterns, cutting, forming and setting together the work in the shop and erecting it on the building. It will be immaterial whether the cornice is to be made from galvanized sheet iron or from sheet copper, as far as the methods are concerned, the only difference being that in sheet copper the joints are soldered, using "killed acid" (acid into which zinc clippings have been dissolved), and soldering on the inside so as to show a clean outside surface. In galvanized sheet iron muriatic acid of course is used and can be soldered on the outside because the cornices are usually painted.

Let Fig. 174 represent the architect's drawing, usually drawn to a scale of ¼, ½, ¾ or 1 inch to the foot. A represents part of the front elevation, while B shows the section. The cornice is to contain brackets and modillions. Crimped iron is to be used in the frieze, as indicated, while the brackets are to have raised

diamond shaped panels and zinc leaf in the front and incised work at the sides. No definite length has been assumed for the cornice and this is immaterial, as the measuring points will be given on the various patterns from which any length can be measured.

Having studied the scale drawing, the next step is to lay out the detail drawing. Paper is now tacked on the large drawing board and the detail drawn, as shown in Fig. 175. This is accomplished by first taking all the vertical hights of the various members in the moldings in Fig. 174 and placing them as indicated on the line A B, by *a*, *b*, *c*, *d*, etc., up to *t*. Horizontal lines are now drawn from these points equal to the projections of the various members obtained from B in

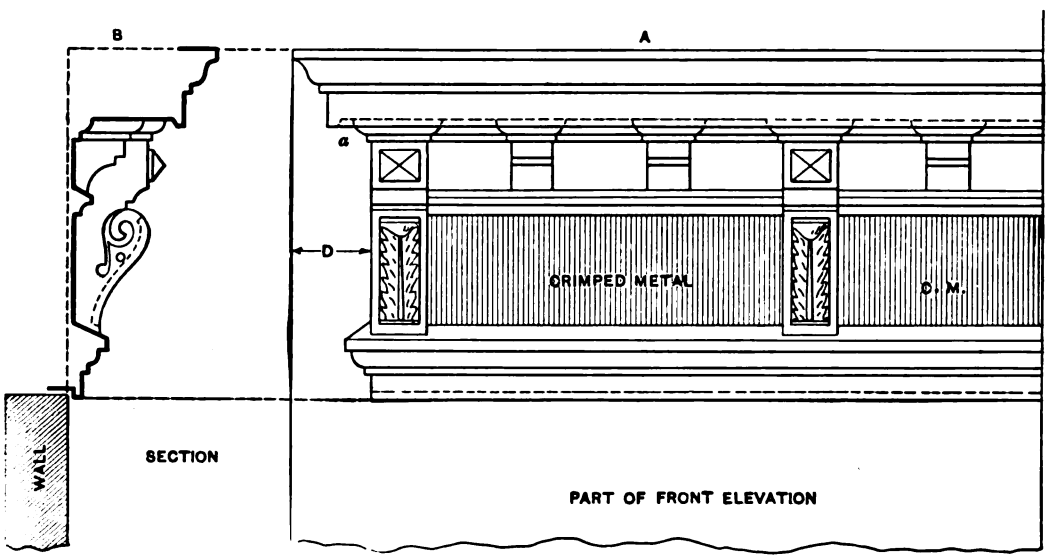


Fig. 174. Architect's Drawing of Cornice

Fig. 174, using the scale rule. The heavy line shown by C D E F G in Fig. 175 will then be the outline or detail of the body of the cornice.

In a similar manner scale the modillion and bracket in Fig. 174, as shown respectively by H and J in Fig. 175. The dotted line J in the bracket shows the sink in the face to receive the zinc leaf, shown in elevation in Fig. 174. K in the detail in Fig. 175 gives the side view of the diamond panel, the elevation of which is shown by L.

It will be noticed that this panel is not square, but is a rectangle, thereby requiring a modified section through R' R", shown by O, in which the vertical hights are the same as in K. For the pattern for the top or bottom of this panel take the girth of 1 2 3 in K and place it as shown by 1 2 3 in S. Draw the usual measuring lines, which intersect by vertical lines erected from similar points

in the elevation, resulting in the pattern S. The pattern for the sides is drawn by taking the girth of 4 5 6 in O and placing it on the horizontal line 4 5 6 in R and obtaining intersections as shown. Knowing the number of brackets to be made, the number of panel miters to be cut are marked upon the pattern.

The pattern for the side of the modillion H is usually pricked direct on to the metal from the drawing. By means of prick punch and hammer the side is transferred to the metal on which laps are allowed, as shown by H^1. In pricking off any work from the drawing to the metal a mistake is often made by doing this pricking direct on the drawing board, which ruins the surface of the board and makes it unfit for drawing purposes. The work bench should always be used for transferring patterns from paper to metal.

Knowing the width of the modillion, which is scaled from the elevation in Fig. 174, the girth of the modillion shown from b' to c' in Fig. 175 is placed as shown by U, allowing a flange shown by the dotted line for soldering purpose.

Drawing T shows how the pattern will appear when pricked from the drawing to the metal for the outside end of the bracket, while V shows the inside of the bracket joining the cornice. The dotted lines show the laps to be allowed. When transferring T and V to the metal the incised work is pricked close and then the figure redrawn on the metal with a lead pencil. Knowing that the bracket has an 8-inch face, as shown by L, the girth is taken for the face of the bracket from a' to v and from x to e' and placed as shown respectively by a'' v' and x' e''. As the sink face is 6 inches, in L, obtain the girth from v to x in the sink shown in the side of the bracket and place it as shown by v' x'. The drawing J^1 represents a tracing of J, on the outside of which a 1-inch strip is soldered, as indicated in L.

Now having completed all the patterns on paper they are transferred in the manner described to metal, and knowing the number required the amount still to be cut is marked on the metal pattern. If there are 10 modillions to be made the side H^1 would be marked "19 more," using marking acid with a small stick cut to the shape of a pencil. This marking acid is usually kept in a small ink bottle, and is prepared by putting some copper filings in muriatic acid. This marking acid turns jet black and cannot be rubbed off the metal when dry. After the metal patterns are all laid out and the amount is being cut at the bench, attention is given to laying out the patterns for the miter cuts and the arrangement for the seam in the cornice.

In the first place the amount of girth must be found in each mold, so that the seams can be placed to avoid any waste of material and to conform with the sizes

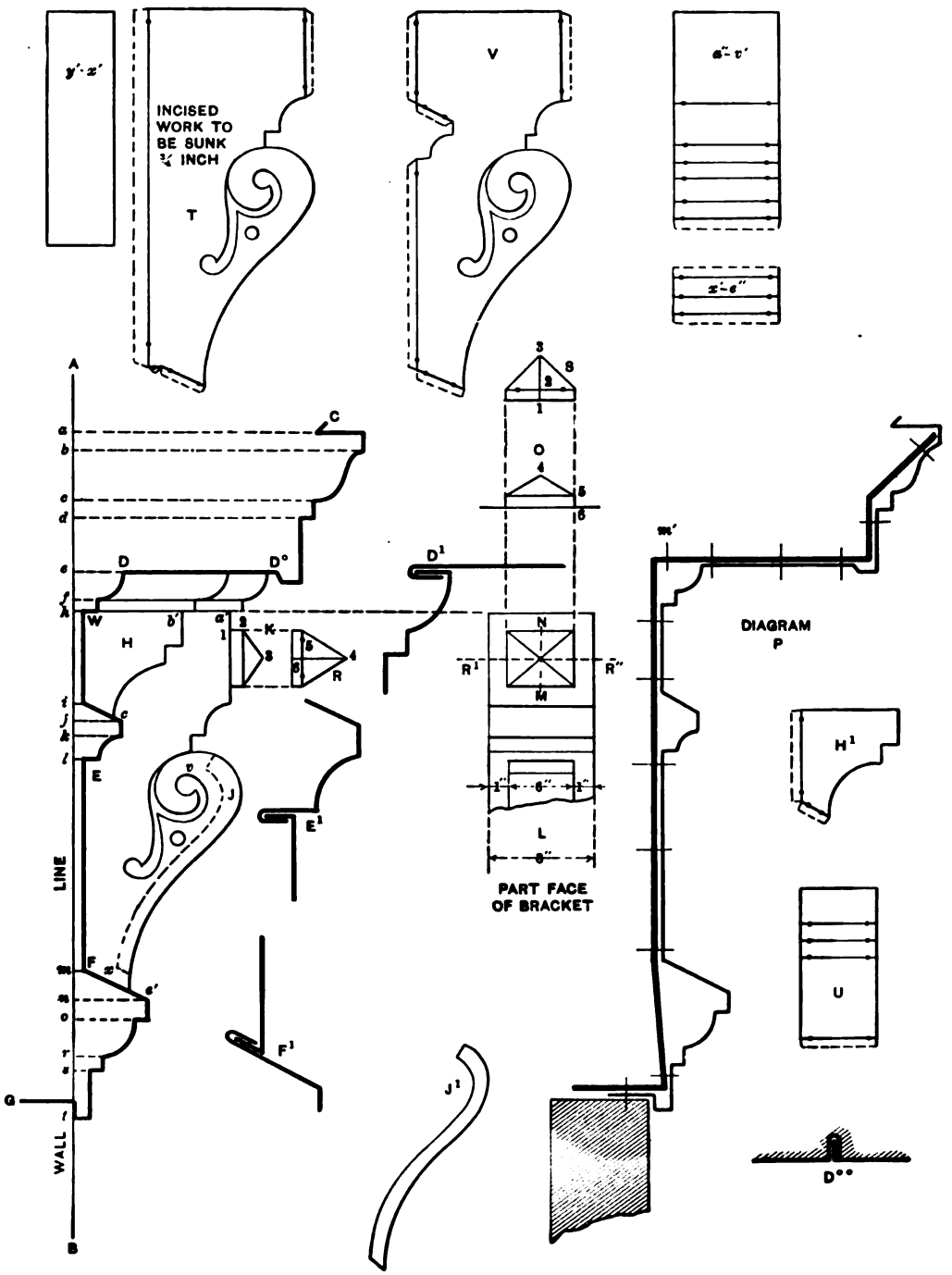


Fig. 175. Detailing the Cornice, Showing Part of the Patterns

in stock. Assume in this case that the seams will come to advantage at D, E and F, and that while it is usual to make a lap seam, either soldering or riveting it, it is better, cheaper and stronger to make a locked seam. This construction gives seams that are rigid and which do not cause waves or buckles in the metal.

As this is very important in cornice construction the method of making these seams is enlarged at D^1, E^1 and F^1, showing the locked seams at D, E and F, respectively. The locks are so placed that they can be easily closed and avoid leakage, as at F^1. Should, however, the girth of the moldings be such that it would be necessary to place a seam in the middle of the frieze E F, or plancher D D°, then the seam would be made as indicated in Fig. 175 at D^∞.

When the cornice is to be of fireproof construction, as they must be in the larger cities, all the lookouts or braces are put as indicated in the diagram P, where the heavy line indicates the iron brace, usually made from $\frac{1}{4} \times 1\frac{1}{2}$-inch band iron. The short lines crossing the mark of the band iron indicate the bolts, while m' is a hole for fastening the cornice to the roof beam, as will be explained.

The incised work in the sides of the brackets is cut as far as possible with the circular shears and the hammer and small chisel on a block of lead. As noted in T the incised work will be stripped $\frac{3}{4}$ inch deep.

To avoid a confusion of lines the outline of the cornice in Fig. 175 has been transferred to Fig. 176, from which the miter patterns are obtained. In practice it is not necessary to transfer any drawing, because paper can be laid over any part of the detail and the various patterns developed as desired. In Fig. 176, C, D, E, F, G is a reproduction of similar letters in Fig. 175. A lock has been placed at C in Fig. 176 for locking the tin plate, and a drip has been placed at G to keep the water from going into the mortar joint.

As the crown mold from C to D can be made from one width of metal, take this girth from 1 to 14 and place it above the drawing on the vertical line B H from 1 to 14. Draw horizontal lines as shown, which intersect by vertical lines, drawn from similar numbered points in C D and resulting in the miter cut J K. A line erected from the wall line P into the pattern, as shown by M N, would give the width or depth of the return. Thus M N O J is the pattern for the returns of the crown molding to which a lap is allowed, as shown by the dotted line *f*. Below 14, on the line B H, edges or locks must be allowed, as indicated by 14, *d*, *e*, with which to form the lock shown in Fig. 175 by D^1.

Assuming that the length of the cornice was to be 26 feet 2 inches at the extreme edge of the crown molding in Fig. 174, then measurements would be taken at point L in Fig. 176 to a similar point on the opposite side, being careful to

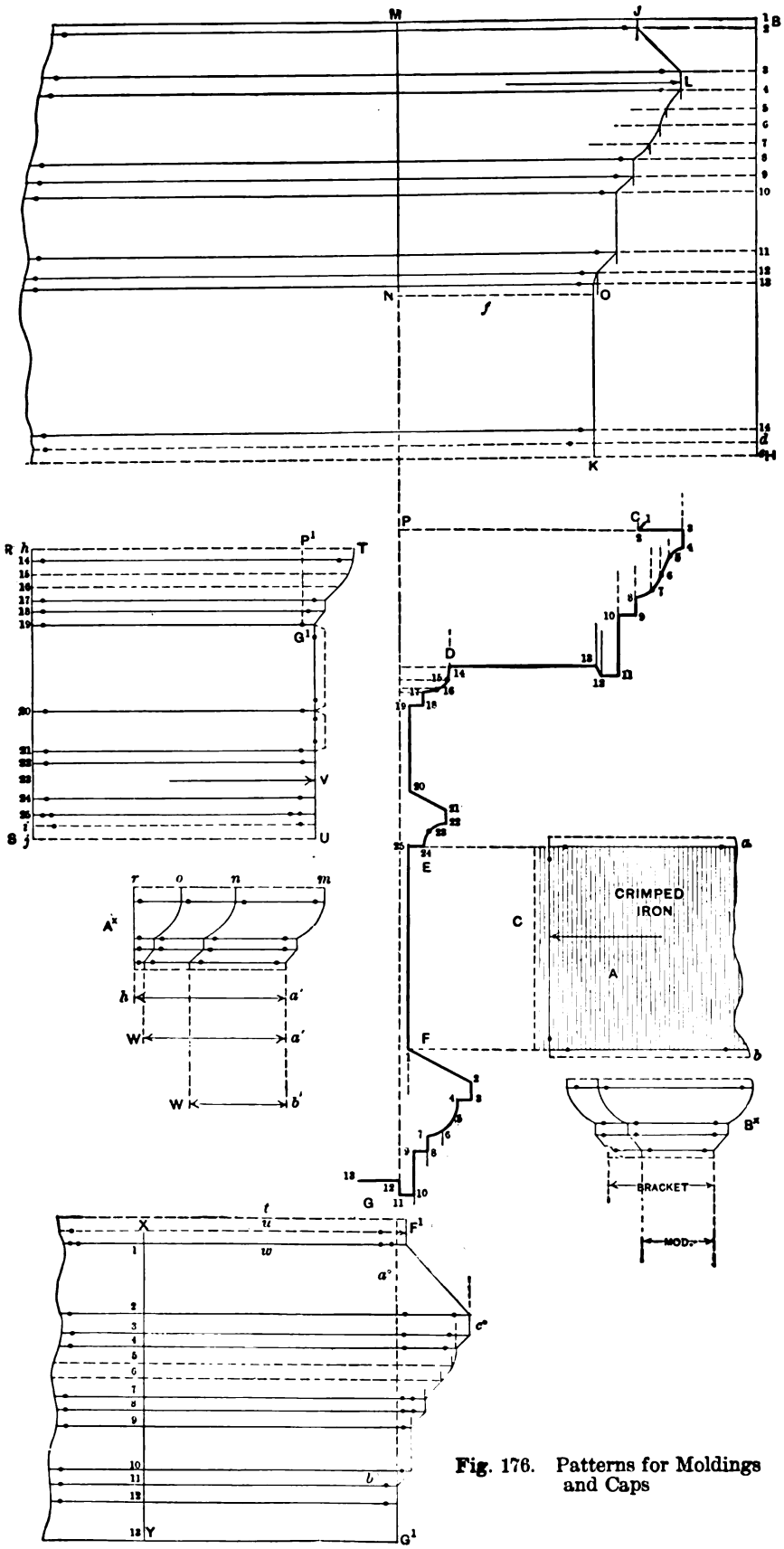


Fig. 176. Patterns for Moldings and Caps

allow for laps. In other words, if 8-ft. sheets were used there would be three laps requiring 3 inches. Then 26 ft. 2 in. + 3 in. would equal 26 ft. 5 in.

Two sheets of 8 ft. =	16 ft.
One sheet of 8 ft. with miter =	8 ft.
Total	24 ft.

Then 26 ft. 5 in. — 24 ft. = 2 ft. 5 in., the length of the short piece with miter, for opposite end.

Referring to A in Fig. 174, it will be noticed that only the cap molding of the cornice miters against the side cap of the bracket at *a*, while the rest of the molding butts against the side of the bracket and is riveted to secure rigid construction. Therefore, in Fig. 176 obtain the girth from D to E and place it on the vertical line R S, as shown by points 14 to 25. Draw measuring lines as shown and at pleasure any short line, as P^1 G^1. Now measuring in each instance from the line P G, take the various projections to points 14 to 19 and place them on similar numbered lines, measuring from the line P^1 G^1. Then is obtained the miter cut T G^1, from which a vertical line is dropped to U, this straight part butting against the side of the bracket. The dotted line indicates the lap allowed for riveting.

Assuming that the projector D in Fig. 174 is equal to 10, then 2×10 in. $=1$ ft. 8 in., which must be deducted from the length of the cornice at A. Thus 26 ft. 2 in. minus 1 ft. 8 in. is equivalent to 24 ft. 6 in., to which laps must be allowed and measurements taken from the point V in the pattern T U S R in Fig. 176.

Having obtained the miter cut of the cap T G^1, this can be used for laying out the caps for the brackets and modillions as shown in diagrams A^x and B^x. Take the distances from *a'* to *h*, *a'* to W and *b'* to W in Fig. 175 and place them in A^x in Fig. 176. Then *m r* is the pattern for the outside cap return for the bracket *m o*, the pattern for the inside cap return for the bracket and *m n* the return for modillion cap.

In B^x is shown the cap faces for bracket and modillion, the width of the faces being obtained from the elevation in Fig. 174. Laps are allowed in B^x, in Fig. 176, as shown by the dotted lines for soldering purposes. In the pattern for the cap molding R T U S in Fig. 176 the locks 14 *h* and 25, *i*, *j* have been allowed, so as to make the locked seams shown by D^1 and E^1 in Fig. 175.

The drawing A in Fig. 176 shows the crimped iron frieze, to which edges have been allowed at *a* and *b* for locking the seam as at E^1 and F^1 in Fig. 175, and also an edge at *c* in A in Fig. 176, for riveting against the side of the bracket.

The girth of the foot molding is now placed on X Y, the usual measuring lines drawn and intersected by vertical lines drawn from similar numbers in F G. Then F^1 G^1 is the desired miter cut. When measuring the frieze and foot molding it should be measured from the points *c* in A and F^1 in X Y the same length as the cap molding—namely, 24 ft. 6 in. A line dropped from the wall line P G into the pattern will give the line a° b°. Then a° b° c° will be the pattern for the two end returns. The dotted lines shown by *t u w* in the foot molding are allowed to make the lock shown by F^1 in Fig. 175. In placing the iron brace shown in diagram P, Fig. 175, in position it will butt against the projecting locks in the cornice (shown enlarged by E^1 and F^1), and the latter should be notched wherever the brace comes in contact to allow the brace to be bolted snugly to the cornice.

To avoid loss of material the frieze shown by A in Fig. 176 is usually cut from plain sheets to the required size and length and then crimped afterward. Assuming that everything has been cut, stays must be obtained with which to form or bend the various molds, faces, caps, etc. Stays will be required for all bends that are not right angles.

PRACTICAL CONSTRUCTION OF A SHEET METAL CORNICE—II

The brackets, faces, diamonds, modillions, caps, returns, etc., are bent on the smaller brake, while the moldings are formed on the large brake in a manner described in previous articles. Assuming that this has been done, the small work is usually put together first, using pointed irons or coppers, as shown in Fig. 177. Four-pound coppers are heavy enough for this work, heating them to a cherry red color and then forging them to a pointed shape, as shown by *a* in the illustration. When soldering small work of this kind the coppers are tinned on four sides for a distance of about ¾ in. Dipping water is usually employed for cleaning the coppers before soldering and is prepared by dissolving about 1 oz. of powdered sal ammoniac in about 1 quart of clean water, using a glass jar for the purpose. Muriatic acid is used as a flux when soldering galvanized iron, and a small cup filled about one-eighth with acid is used in connection with a small brush to convey the acid to the metal.

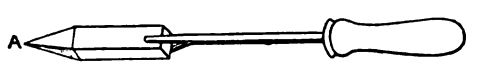


Fig. 177. Pointed Copper

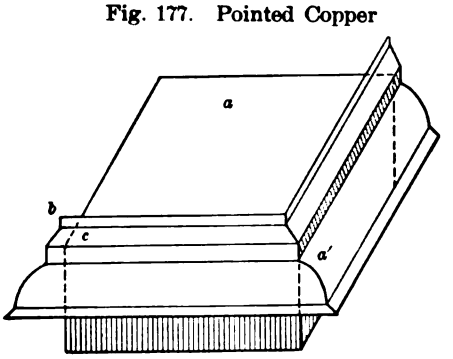


Fig. 178. Block for Soldering Caps

In putting together the modillions and brackets the diamond panels can be first set together, joining in two halves and then into one unit. When setting the caps together a square block of wood or brick can be used to advantage, as shown in Fig. 178, on which to tack the miters, thus saving the time of always holding on the carpenter's square to true the work. After the miter a' has been tacked, the miter b is placed on the corner of the block c and the opposite return put in position. In soldering the modillion together, lay one side on the bench and tack on the face; when the bends in the face run parallel to each other, tack on the opposite side and solder. The cap is now placed in position and soldered.

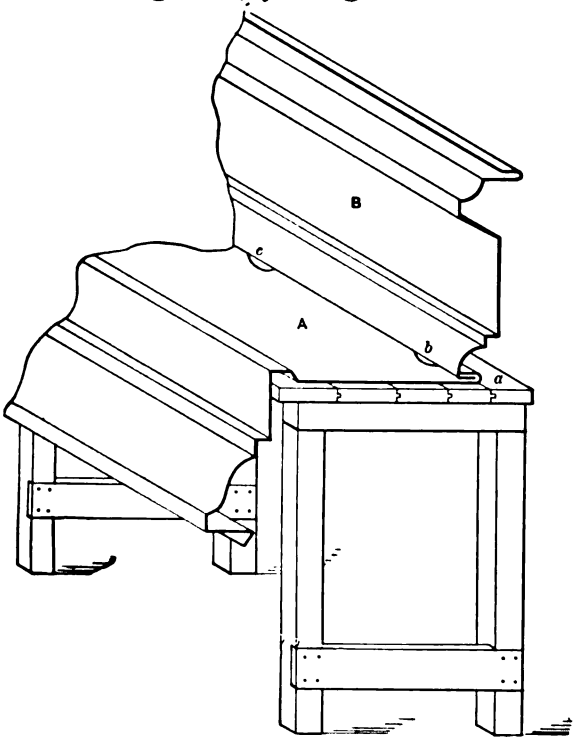


Fig. 179. Joining the Moldings

After the incised work in the sides of the bracket are sunk the sink strip shown by J[1] in Fig. 175 is stripped with a 1-in. strip, as called for, and soldered in its proper position on the side of the bracket. The front is now tacked on the side, as explained in connection with the modillion and the opposite side placed in position. Sight the bracket, so that there will be no twist in it, after which the sink face, shown by v' x', is soldered to it. Set on the cap and tack in the sunk face for a stamped zinc leaf, and the diamond panel on the top face. The zinc leaves are purchased from dealers in pressed ornaments. It is always best to modify the width of the face of the bracket to suit the size of the ornament or leaf.

The small work being completed, the moldings are set together as shown in Fig. 6, in which the plancher A is laid on the bench and the modillion course B is locked to the plancher of the crown molding, as crown at a. Slight tacks are made at b and c to keep the moldings together until the lock a is closed.

The cornice A B is now placed in the position shown by A B in Fig. 180, setting the lower part of the modillion course B near the edge of the bench C, as shown at b, and placing at intervals braces, of either band iron or wood, having the required length, as shown by K, to keep the cornice in its proper position. The architrave or foot molding D is now placed at the opposite edge of the

bench, being held in its proper position by the braces J, the distance between the architrave D and modillion course B being such as to admit the locking of the crimped frieze E at *a* and *b*.

Slight tacks with solder are now made to keep the cornice rigid, when the brackets are soldered in their proper positions, after which the modillions are placed and soldered. Where large flat surfaces occur, as at A, B and E, laps are allowed on the modillions and brackets and riveted; this also applies to the cross seams in the moldings.

After the returns have been placed on the crown and foot moldings the braces

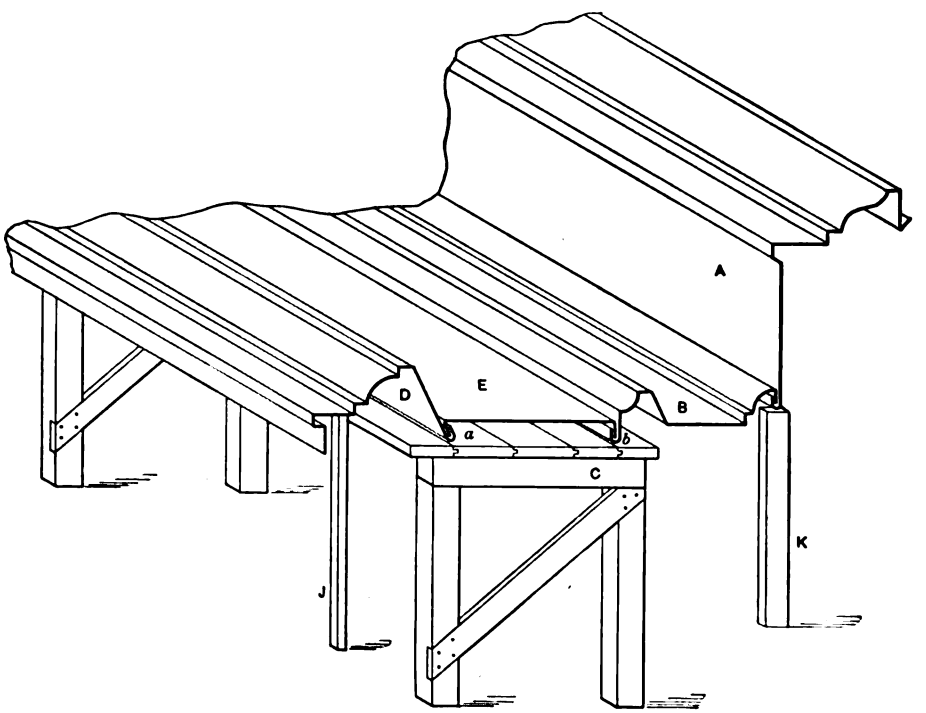


Fig. 180. Joining the Frieze

are ready to be put in. These braces are usually made from 3-16 or $\frac{1}{4} \times 1\frac{1}{4}$-in. band iron, being careful to use soft iron or steel so that they can be bent cold. They are usually bent on the brace bender or vise, to conform to the shape shown in diagram P in Fig. 175, punching the holes as the bends are made. These braces are usually placed about 5 ft. apart and are fastened with $\frac{1}{4} \times \frac{3}{4}$-in. stove bolts in a manner shown in Fig. 181. As before mentioned, the locks at *a* and *b* are notched out to allow the brace to lay flush against the back of the frieze. The small dots *x*, *x*, etc., indicate the bolts. Flat bolts are employed at the drip and then round head throughout.

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After all the braces are in position the cornice is carted to the job in 24 or 25-ft. sections and hoisted to the wall of the building by means of a derrick and fastened to the wall and beams as follows: After the wall has been carried up to the required hight, as shown by A, the flange B and brace C is set upon it, as shown. Galvanized soft steel wire is now fastened around the brace at C and fastened to the second beam D on the hook shown; this wire is to draw the drip E snug against the wall. A second wire F, is now fastened to the brace at H and fastened to the

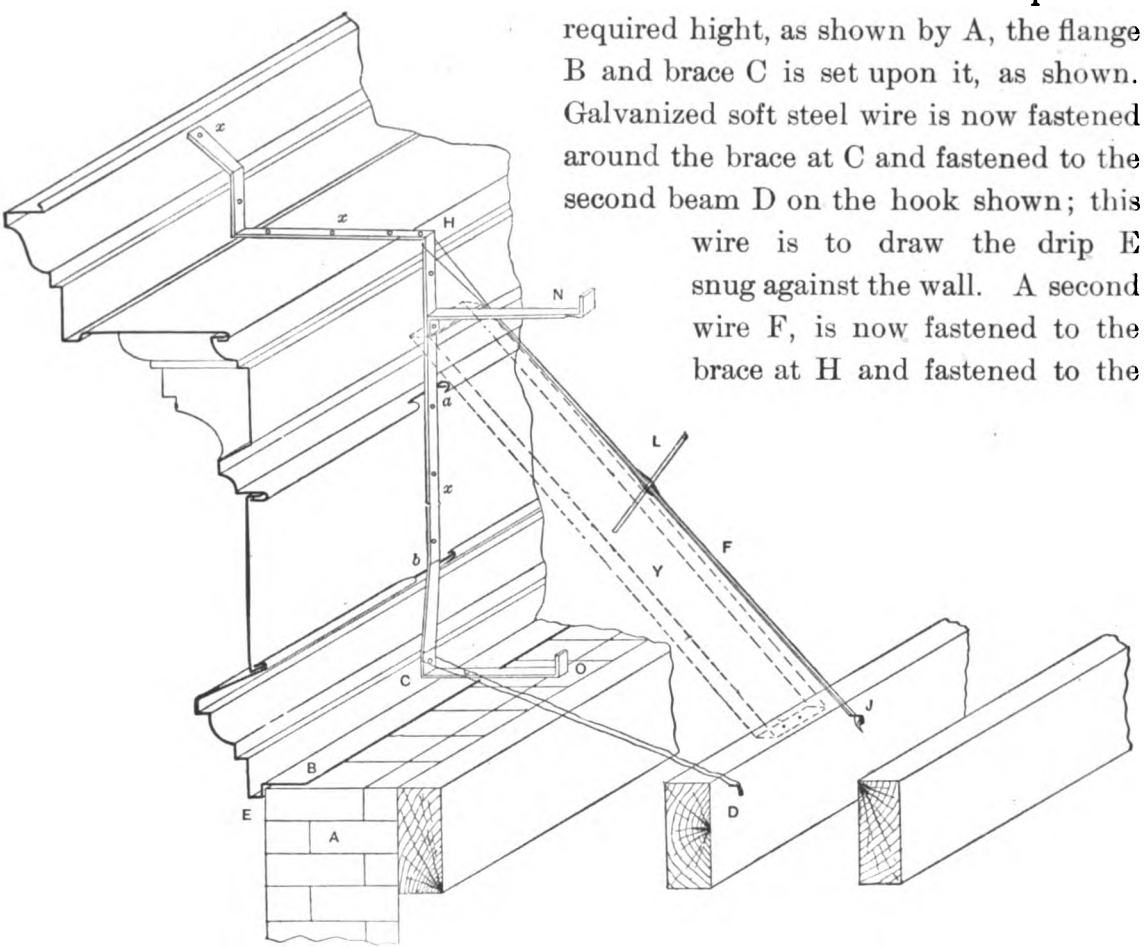


Fig. 181. Fastening the Cornice to Wall and Beams

hook driven into the second beam at J. Care must now be taken so that the cornice stands plumb. Oftentimes the beams are quite some distance above the drip of the cornice, B, Fig. 181, and if wires, for the bottom of the braces were fastened to the beams, the wire would have a tendency to lift the cornice from the wall. In a case of this kind, the wires are carried down the wall to the wood lintel over the windows.

When all the wires are fastened and the guy ropes loosened, the tendency of the cornice is to lean outward, owing to its weight. Should this happen the cornice can be drawn in to a plumb position by inserting a piece of iron rod or band, as shown by L. Then by turning this band the wire will twist and shorten and draw in the cornice as desired. The anchor N is now bolted in position, and

another at O, providing this has not already been bent direct to the brace. The cornice being plumb and the anchors in position, it is ready for the mason to back up his cornice. Sometimes the cornice is set at such a time that the mason work cannot be done the same day and the cornice must be fastened in such a manner that a storm over night will not do any damage or perhaps blow the entire cornice off the roof. The wires C and F keep the cornice from being blown into the street, and to prevent the cornice from being blown on the roof a wood brace is placed under

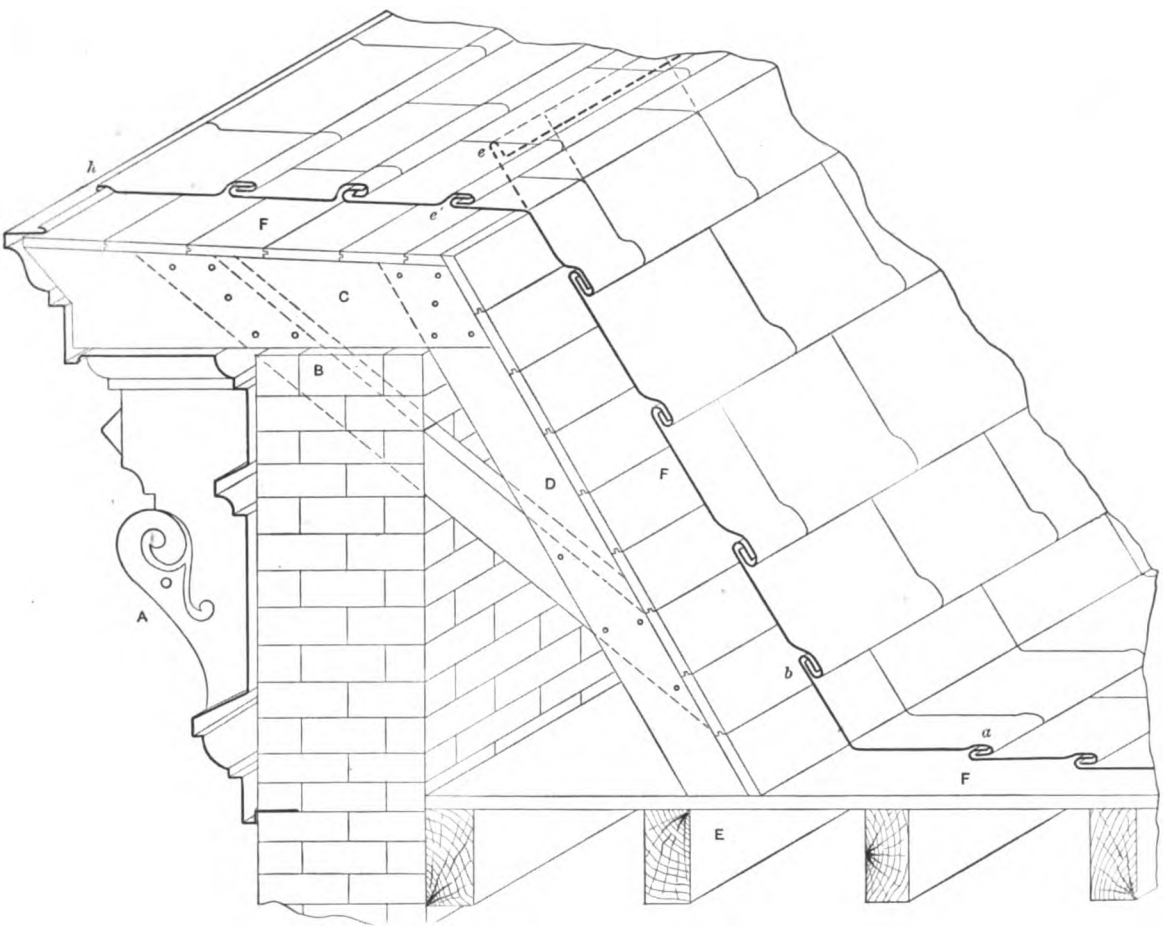


Fig. 182. Backing up and Covering the Cornice

the anchor at N, as shown by Y, and nailed to the second beam. By placing these wood braces at every second brace damage which might occur can be avoided.

If the wall has been carried up, as shown by B in Fig. 182, the cornice is held in position, and if necessary the wires can be removed if in the way. The wood brackets C, D are now put in position by the framer and the roofs planked as shown by F, F, F, being careful that the planking comes snug under the lock of the cornice at *h*, when the roof is ready to be covered with tin plate. Before the

tin plate is laid care should be taken to see the roof boards are even, and that the nail heads do not project above the boards, which causes rust holes in the tin plate from the bottom. If a good job of roofing is required the under side of the tin and upper side of the boards should be painted with a coat of roof paint mixed as follows: Six pounds of Venetian red in oil with 1 gal. of boiled linseed oil, and to this added 1 lb. of litharge in powder, which must be well stirred while using. The litharge gives the paint a very hard surface and adds greatly to its lasting qualities.

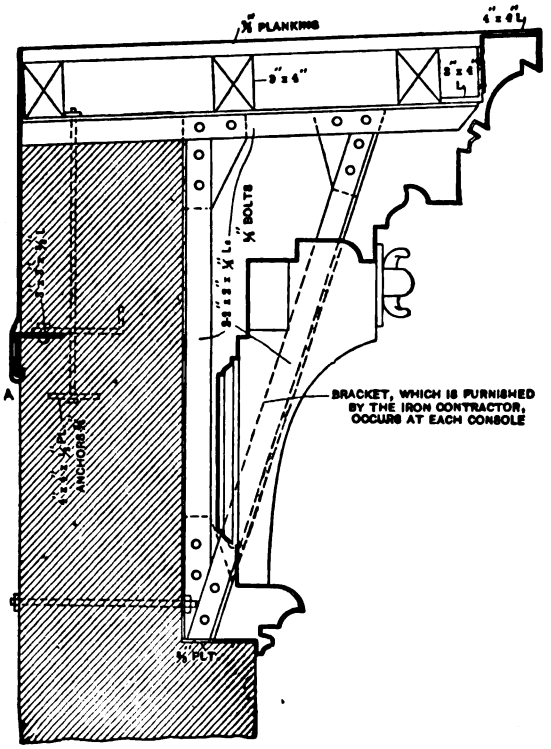


Fig. 183. Cornice of Fireproof Construction

Assuming that the tin has been laid with cleats and the last lock is as *a*, then a flashing is placed as shown from *a* to *b*, after which the sheets are laid in regular order, as shown, up to *d*. From *d* the sheets are again laid in the usual manner, letting them project above the top of the cornice as shown by the dotted line *e*; after this *e* is turned down on the roof, as indicated by *e'*. Continue laying, locking the last course into the cornice at *h*. The locks are now closed by means of the mallet and the top of the cornice and main roof soldered, using rosin as a flux for the tin plate and "killed acid" as a flux for the joining between the cornice and tin at *h*. Before closing the seams on the back of the cornice, paint the seams with red lead in oil and then close with the mallet; after this paint the seams again and the joints will require no soldering.

In fireproof construction, where no wooden beams are allowed, the method of fastening the cornice is done as shown in Fig. 183, in which a sectional view of a cornice fastened to angle iron construction is illustrated. In this case the angle iron brackets are built in with the wall and the cornice set so that the angle iron bracket comes directly in the center of the sheet metal bracket, according to measurements previously given. It will be noticed that after the cornice has been fastened to the angle iron work 3×4-in. joists are laid, over which the planking of the top of the cornice is laid. The roof is then laid, flashing down the wall and locking into the angle iron at A, which forms a drip.

A TYPICAL CORNICE JOB

The study of cornice work is more readily understood and more profitable when some particular piece of work is followed. As an example, a cornice has been selected that is to be erected upon a brick building, of slow burning construction, the furring being of wood. In such cases the carpenter usually furnishes the wood backing to which the cornice is secured. Therefore, in taking off the quantities from the architect's plans, it is only necessary to allow for such wrought iron stiffening braces as are necessary to hold the cornice in shape.

A cornice is considered that is to be made of galvanized iron, about 5 feet high, with a projection of 3 feet, having stamped zinc modillions, egg and dart moldings, dentil course, plain paneled frieze and foot molding, somewhat as shown in the section, Fig. 184, and the elevation Fig. 185, the top and back of wall being

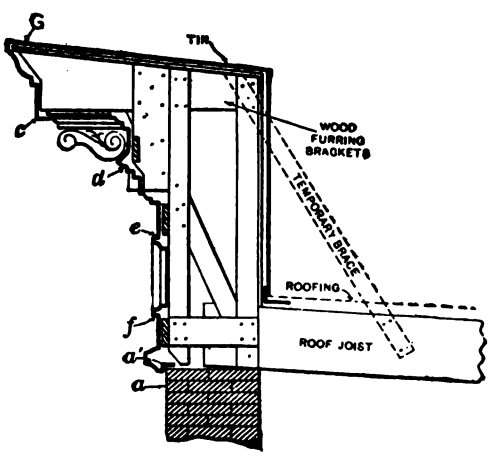


Fig. 184. End Elevation

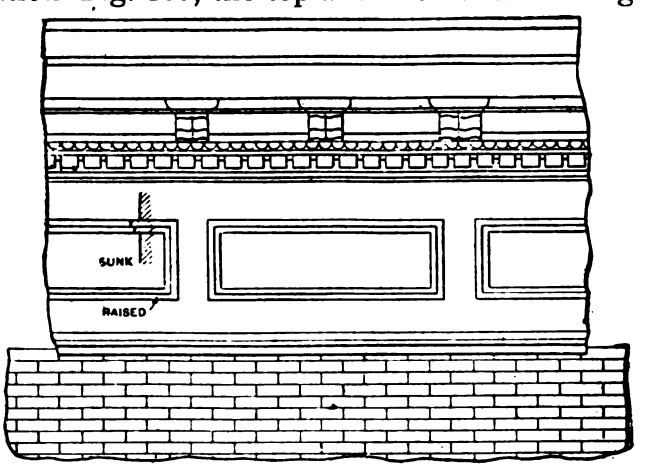


Fig. 185. Front Elevation

of tin. In estimating the items should be separated as follows: Tin work, plain cornice molding, zinc modillions, stamped zinc molding, dentils and paneled work and braces.

By getting the number of square feet of molded work the weight is easily ascertained, and if proper records of the cost of different classes of work and parts of cornices have been kept, the labor cost per pound, or per square foot, of the different parts of a cornice is easily ascertained. The cost of the zinc modillions is, of course, governed by the size and number, and that of zinc moldings by their size and design. The number and strength of the wrought iron stiffening braces, as shown in Fig. 186, depends upon the size and weight of the cornice.

The first step in executing the work should be to measure the building and make a dimension drawing. The measurements should be taken on the wall line,

point *a*, Fig. 184. Having thus found the exact dimensions, the next step is to ascertain the number of dentils and modillions required and get them under way. Also have the wrought iron braces, A, Fig. 186, made and get out the paneled work. The plain moldings are the simplest part of the cornice and can be left for the last thing.

If the panels in the frieze are raised, in addition to dimension drawings, a scale drawing, showing the elevation of the cornice, should be made in order to ascertain the exact number and spacing of the panels. If the frieze paneling is not raised the elevation drawing is not absolutely necessary, as the horizontal members, *b* and b^1, Fig. 187, of the paneled frieze should be formed integral and continuous with the cornice and the panel posts, b^3, planted on as required, thus dividing the frieze

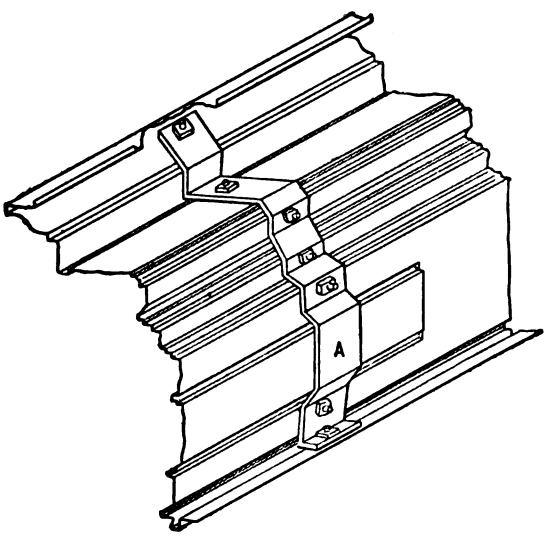


Fig. 186. Wrought Iron Braces

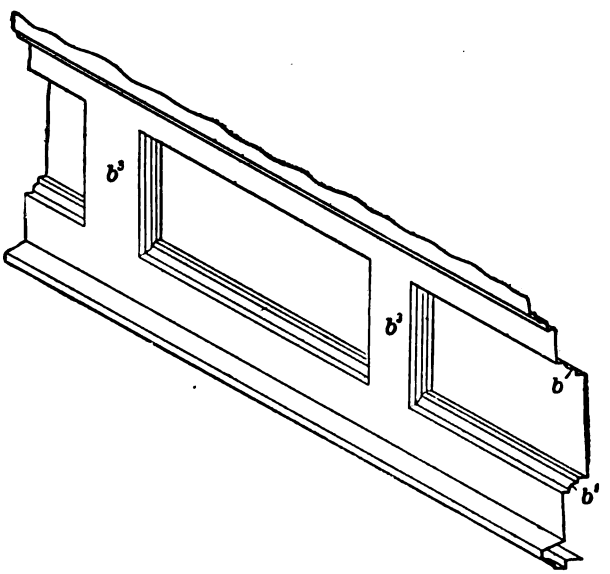


Fig. 187. Panel and Foot Mold

into a series of sunk panels. It will be seen that sunk paneling is much easier to execute than raised paneling, as in the latter case it is necessary to space and cut the panel molds to the exact length required, considerable mitering resulting.

Generally it is advisable to have the different parts of the cornice made in separate pieces, in order to facilitate handling and assembling. For instance, by having seams at *c*, *d*, *e* and *f*, Fig. 184, the modillion, dentil and paneled frieze courses are separated, so that all can be worked on at the same time by different men. The time saved and convenience gained by having these seams more than offset their extra cost, as compared with forming the moldings continuous in girth. Moreover, the relative girth of the cornice and widths of metal from which it is to be made generally necessitate seams in a cornice of this size somewhere near the points

indicated. All brackets, dentils and other members which are planted on the cornice proper should be provided with rivet laps and be securely riveted to the cornice. In fact, solder should not be depended upon to hold any part of the work together, as, in addition to ornamentation, a metal cornice is usually required and depended upon as a protection against fire. Therefore, it should not be constructed in such a manner that any part of it will be injured by an adjacent fire.

After the different members of the cornice have been completed and the brackets and dentils all properly spaced and secured in position, the entire entablature should be assembled and the seams at the points *c*, *d*, *e* and *f*, Fig. 184, properly joined and riveted or clinched. The wrought iron braces, A, Fig. 186, should then be secured in position by brass bolts, if the cornice is of copper, as indicated, the braces being spaced not more than 4 feet apart.

Usually, if the cornice maker will confer with the builder at the outset, an understanding as to the settings and furring for the cornice can be arrived at, which will not only facilitate the work of the metal man, but will result in a superior job.

The cornice should be formed with an offset or drip member at its bottom edge, where it comes in contact with the wall, as indicated at a^1, Fig. 184, which member facilitates setting the cornice. The wall should be built up to this point and stopped. Then wood furrings, as indicated in Fig. 184, consisting of brackets conforming generally to the shape of the cornice and spaced not more than 30 inches apart and joined by a few horizontal strips secured to their faces, as indicated, should be furnished and set on the wall by the carpenter, and temporarily braced in position by braces from the roof, as indicated by the dotted lines.

The boarding of the top and back of these furring braces, on which the tin is to be laid, should be left off, except a narrow strip, G, about 3 inches wide, along the front edge. A staging should, of course, be left or provided on the front of the building, on which the workmen can stand and work on the face of the cornice.

The boarding being left off the furring brackets leaves the entire back of the cornice accessible, thus making it comparatively easy to set the cornice and make the seams. This method of open work furring allows the use of a derrick, set on the roof, with tackle suspended directly over the center of gravity of the cornice, so that the 16-foot sections can be drawn directly up into position, the tackle being secured to the cornice by fastenings to the braces, A, Fig. 186. The cornice should be secured to the wood furring by means of brass screws and large washers. Iron bolts or nails should not be used, as they will rust and produce a reddish streak on the face of the cornice below each bolt or nail, caused by the oxide of iron being washed down the face of the cornice.

After the cornice is completed, and before the boarding is put on to the furring, the brick wall should be extended up to the top of the cornice, thus securing the wood furring in the wall and affording a firm and permanent support for the cornice that will withstand both fire and wind.

The temporary braces can now be removed, the main roofing finished and flashed up against the back of the wall, and the boarding applied to the furring and covered with tin, which should extend down over the flashing. Building paper should be used under the tin.

In buildings of steel construction, and often in ordinary brick buildings, as here indicated, the cornice furring brackets are constructed of angle iron braces secured directly to the structure of the building, or built in the masonry, and have on their faces auxiliary iron straps formed to the general contour of the cornice, and to which it is bolted. In place of boarding, steel structures have the tops and backs of the cornice covered or filled in with terra cotta blocks.

COPPER CORNICE WORK ON FIRE PROOF BUILDINGS—I

With the construction of large iron fire proof buildings, work in sheet copper for the roofing trade has increased. There is more sheet copper used today in the roofing trade than ever before and a large amount is used on the buildings above mentioned. The fastening of sheet metal or sheet copper to non-fire proof buildings is a simple matter, as wood is mostly employed. With the fire proof building construction of today, however, the roofing and cornice worker has to prescribe the best methods for obtaining water tight joints between the sheet copper and stone, brick, terra cotta and iron.

It is very seldom that two jobs are alike, and for each job there must be devised methods for putting up the work, fastening it and obtaining water tight joints under the conditions above named. In this article will be described, by means of diagrams and descriptions, the methods employed in practice for fastening copper or any other metal cornice work on iron or stone structures, also different methods of iron bracings constructed in such a way that the cornice stands free from any wood work. As all exposed cornice and other work usually remains without paint, methods will be described showing how joints and seams in ornamental copper work are soldered or riveted so as to leave a clean outside surface.

In setting up a galvanized iron cornice the moldings are usually put together on the bench, turning them backward or forward and tacking the seam where most

convenient, for so long as the work is true and straight it makes no difference whether the seam is soldered inside or outside. In copper cornice work, however, the seam must be soldered on the inside, so as to show a clean appearance on the

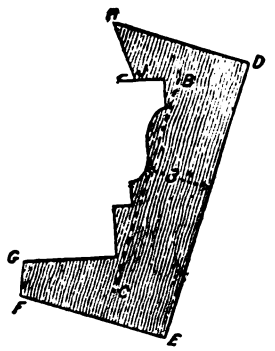


Fig. 188. Method of Obtaining Shape for Wooden Blocks

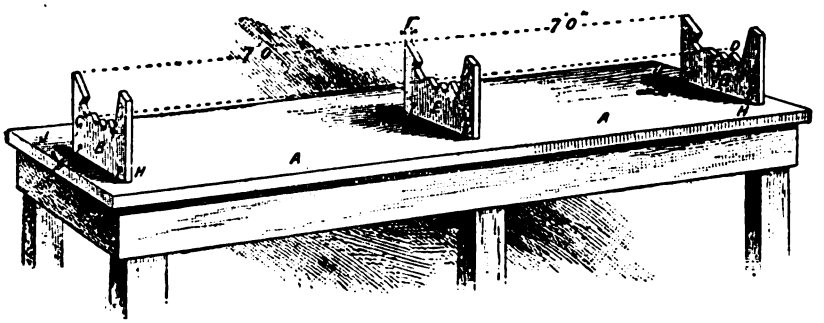


Fig. 190. Method of Using Wooden Blocks when Soldering Cross Seams

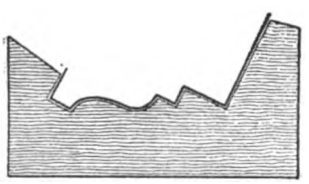


Fig. 189. Showing Allowance to be Made on Wooden Block

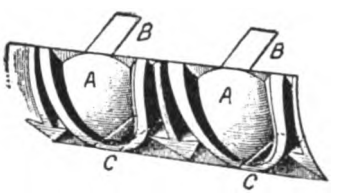


Fig. 192. Flanges Used to Avoid Soldering

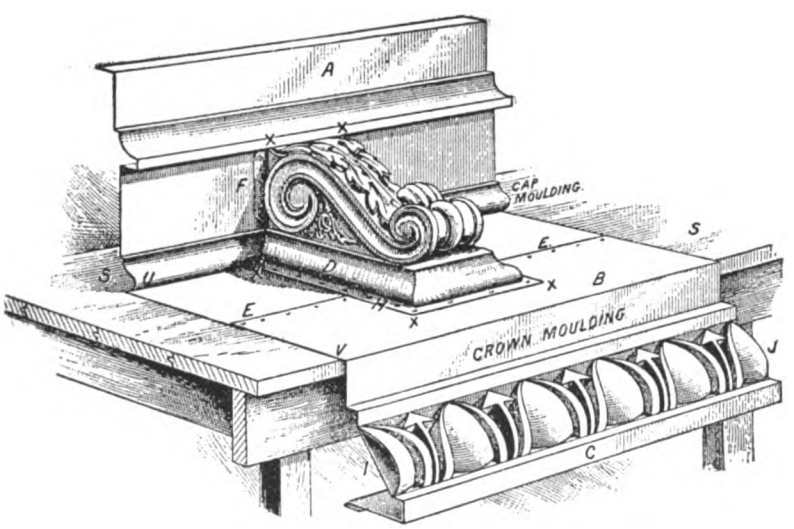


Fig. 191. Method of Fastening Modillions on Copper Cornices

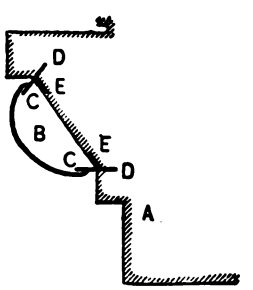


Fig. 193. Method of Bending Flanges Inside of Molding

outside, and is accomplished as follows: In Fig. 188 let A represent the profile of a crown mold to be made from cold rolled copper, the outside of which should be perfectly clean. Average the profile A by the dotted line B C. Parallel to B

C at a distance of about 3 inches draw D E. At right angles to D E, from the points D and E draw lines D H and E F. Draw a line from F to G and H to J. Then will J H D E F G represent the reverse profile or pattern from which to obtain the wooden blocks on which the molding will be set together. Obtain a spruce plank of the required width by 1¼ inches in thickness, on which with the use of the pattern, Fig. 188, and pencil, mark off the number of blocks desired, and have them cut out by a wood worker by means of a band saw, the sawing of the blocks costing but a few cents. Due allowance should be given when sawing the blocks so that the sheet metal molding will pass in and out easily, as shown in Fig. 189.

Fig. 190 is a perspective view, showing the method of using the wooden blocks when soldering the cross seams. Let A A represent the work bench, which should be perfectly level. At a convenient distance from the edge of the bench, as H and H, nail the two end blocks B and B, as shown. Tack a nail in the edge of the bench, as at F, fasten a chalk line to it and draw across the member C taut over to the other end block, as shown at D, and fasten this end of the line. Supposing that a molding was to be put together of 13 feet 11 inches, having 1 inch lap. Two 7-foot sheets would be required and the blocks would be set 7 feet apart, measuring from outside to outside of block, as shown in Fig. 190. The chalk line C D being drawn taut the center block E would be placed in its proper position so that the line would touch the same member as on the two end blocks. The three blocks being firmly secured, hundreds of feet of molding having that length of 14 feet could be set together without removing the blocks. If the molding was desired longer, more blocks would be employed. When the molding is tacked together by means of solder it is taken off the blocks and the seams riveted, there being room for this operation on the rear of the bench J J; after which by means of a small hammer the seam is set down well from the outside and soldered on the inside. A mistake often made by mechanics is to solder the seam on the inside first and then rivet afterward. This is wrong. By soldering the seam first the solder flows between the seams, and then when riveting, instead of the rivet head showing flat and smooth on the outside, the solder between the seam expands by the blow of the hammer and causes the head of the rivet on the outside to bulge out. By riveting the seam first this is prevented, the outside seam being perfectly smooth and flat.

Referring to Fig. 191, let S S represent the work bench, upon which the crown molding B C is hung in the position as shown, and is connected to the cap molding by means of a seam shown at E E. As no solder should show on the

outside of the seam, the distance U V being obtained, the seam is tacked by means of roofing nails through the laps, the holes caused by the nails being afterward used for the rivets. Care should be taken in tacking the seam E E to avoid the buckles in the metal; by commencing to tack in the center of the sheet the buckles will work out toward the ends. If the sheet is tacked at the end first, and it is attempted to work out the buckles toward the other end, the result will be that the sheet becomes buckled throughout the entire length. D in Fig. 191 represents a modillion consisting of stamped front and sides, the joint of which is soldered on the inside. A lap is allowed on the cap molding, as shown at H; also a lap on the body of the modillion, as shown at F. When tacking the modillions in the cornice, make small tacks with solder at X, X, X, etc., after which tip up the cornice, laying the surface F upon the bench S. Then rivet the seams between the crown and cap moldings, the flange of the cap H and body F with copper rivets of the required size, all as indicated by the small dots.

It is often the case that an enrichment is to be placed upon some molding, as the egg and dart, for instance, shown by I J. In a galvanized iron cornice this could easily be tacked with solder upon the body of the molding, but it should not be done in copper work. In Fig. 192 is shown the method by which flanges may be used. Let A A represent the egg and dart molding, having the flanges B B and C C attached by soldering. A in Fig. 193 shows a section of a molding similar to that used in the cornice in Fig. 191. B in Fig. 193 represents the egg and dart. By means of a small chisel and hammer cut slots in the corners of the molding wherever necessary and slip the flanges through, as shown by D D. Now press the egg and dart B well against the molding A, and bend over the flanges D and D, as shown by E E. In this manner various ornaments and enrichments are fastened.

COPPER CORNICE WORK ON FIRE PROOF BUILDINGS—II

On some of the iron structures the store fronts are not projected but run flush with the front line of the wall, the iron beams overhead being covered with a metal panel or cornice. In Fig. 194 is shown one of the methods of fastening panel work to the iron beam. Let A represent the iron beam and B B the panel course. The hight of the iron beam being obtained, the panel is made of similar hight, having a brace, D, bolted to it at E E with brass bolts, the holes E E being countersunk so that the bolt head will show a smooth surface on the outside. An angle is bent at the bottom of the brace D, as shown at F, which supports the panel. A drip is bent, as shown at G, against which the window front is laid, and gives a water

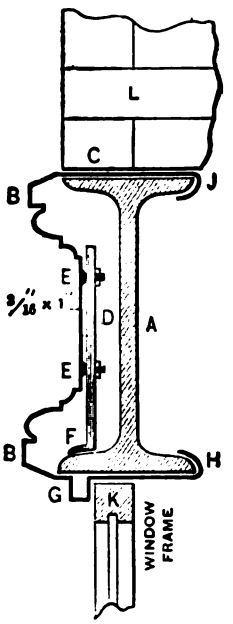


Fig. 194. Panel Work Attached to Iron Beam

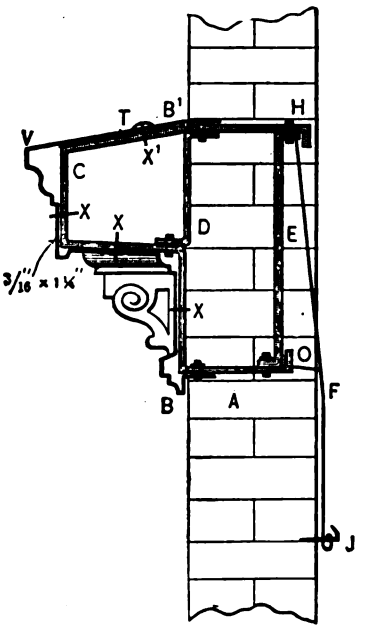


Fig. 195. Method of Building in Metal Sill or Lintel Courses

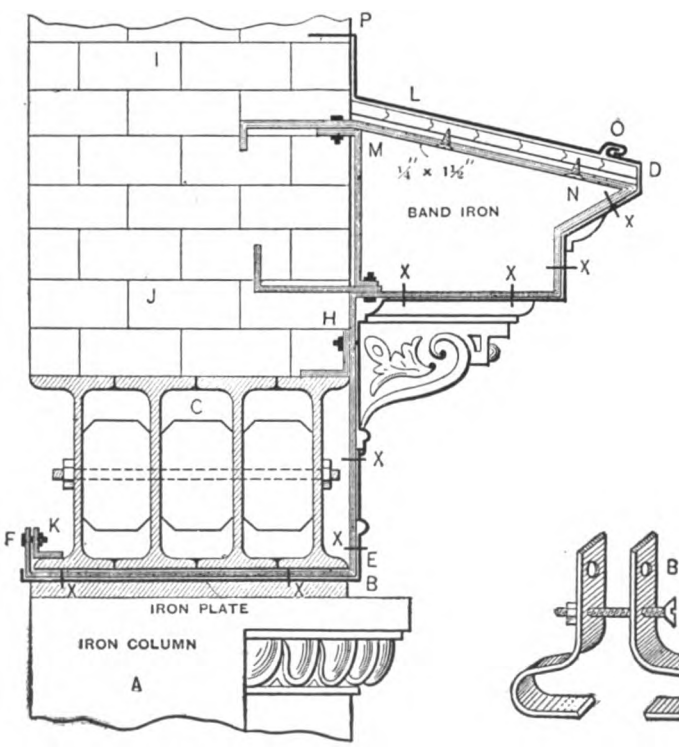


Fig. 196. Fastening Metal Store Cornice on Fire Proof Building

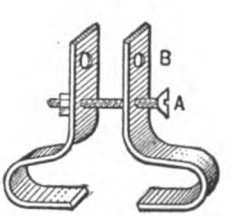


Fig. 197. View of Clasp

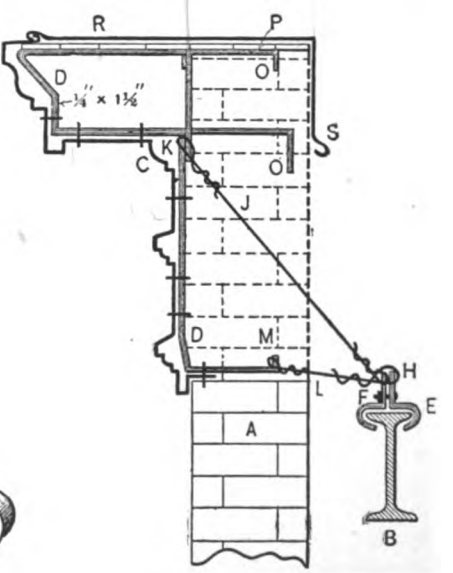


Fig. 198. Sectional View, Showing Temporary Fastening of Cornice

tight joint. When setting the panel place the brace D F upon the bottom flange of the iron beam and bend the flange of the metal, as shown at H. At C at the top, solder strips of metal to the flange C and bend them over the top flange of the beam, as shown at J. The seams of the panel are riveted with copper rivets, thus making the panel strictly fire proof. After the molding is put up as described the brick wall L is built over it.

It is often the case that a sill or lintel course is required of copper, the stone being too heavy or too expensive, while copper is light and durable. This course should be built in as the work progresses and braced, as shown in Fig. 195. Let B B^1 represent the sill or lintel, having a drip at the bottom. After the brace C D E is bolted together, as shown by the various bolts in the illustration, it is fastened to the cornice with $\frac{1}{4} \times \frac{3}{4}$-inch brass bolts, the bolts passing through the metal of the cornice, as shown at X X X; the holes for these should be countersunk. The roof of the course is bent on, as shown from V to Y, a bolt passing through at X^1 and Y. Over the bolt X^1 a cap, T, should be soldered, which prevents leakage. The wall A having been built up as high as required, set the cornice (to which the braces have been bolted) on to the wall, and draw in the drip snug against it by means of a wire fatened at O and drawn down, and fasten to the hook J. Set the cornice perfectly level and plumb, fasten a wire at the top of the brace H and draw it down, and fasten to the hook J at the bottom. When this is completed the mason can go ahead with his wall above A, which holds the cornice free from any support.

Fig. 196 represents a store cornice of copper, the show window running flush with the wall line. Let A represent the iron column upon which the iron plate B is laid, and on this plate the iron beams C are placed. Before the mason can go any further with his work the cornice must be set, as follows: Let D E F represent the copper cornice, the copper extending around the bottom of the iron beam from B to Y and F. The braces are constructed as shown in the illustration, having the proper bevel of the roof, as indicated by M N, and bent in such a manner that an allowance is given for the wooden planks to slip under the lock of the top of the cornice D. As will be seen the braces extend under the iron beams, and the copper cornice is attached to the brace by means of brass bolts X X X, etc., countersinking the holes in the braces as before mentioned. When setting the cornice, slip the bottom of the brace under the iron beam C, raise up the cornice until the bottom of the brace is tight against the bottom of iron beams and bolt the angle to the main brace at H. Then draw up the brace F against the bottom of the iron beams and bolt on the angle K, It should be remembered that the holes

should be punched and angles fitted in the shop before the work is put up, so as to have no unnecessary delay. The cornice being set true and level, the mason finishes his wall to I. In work of this kind the iron braces should be spaced about 3 feet apart, so as to support the planking for the roof. The framer now planks the roof over these braces, putting in wood screws from the bottom of the brace, as shown, to secure the wood work, after which the roof is covered with copper, locking it into the lock at O and flashing into the wall at P. After the lock is soldered at O the mason finishes his front wall.

When fastening cornices temporarily on non-fire proof buildings, the method usually employed is to nail them to the wooden beams. In fire proof buildings this cannot be done, nor could the wire be twisted around the iron beams, because it is often the case that the brick arches are already built between the beams. To overcome all this a clasp made of band iron, of strength sufficient for the weight of the cornice, is made of the shape shown in Fig. 197, and is applied in practice as indicated in Fig. 198. Referring to Fig. 197 it will be seen that two holes ¼ inch in diameter are punched in the clamp, a bolt passing through the hole A and a wire for fastening the cornice through B. In Fig. 198, A is the brick wall upon which the cornice is to be set, and B the iron beam to which the cornice is to be fastened temporarily until the brick wall is built up. C is the main cornice, having the brace D D attached to it as before described, allowance being made on the brace at the top to permit the planking to pass under the lock on the cornice. Anchors, shown by O O and M, secure the cornice to the brick wall when built up. When setting the cornice place the anchor M upon the wall A and have the clasp E fastened upon the iron beams where required. Bolt together at F, pass a wire—say 9 gauge—through the hole in the anchor M, also through the hole in the clasp at H, and twist it until the drip is drawn tight against the wall. Now fasten a wire through the brace at K, draw it taut until the cornice stands plumb and then fasten it into the clasp at H. The cornice is now fastened temporarily, which allows the mason to run up his wall, after which the roof of the cornice is planked by the carpenter and covered by the roofer with copper, as shown by R, locked into the front lock and turned down over the wall with a drip at S.

COPPER CORNICE WORK ON FIRE PROOF BUILDINGS—III

Fig. 199 shows a sectional view of the upper part of an iron structure filled in with brick work, and also the method of fastening the cornice work to the iron brackets, which are bolted and riveted to the iron columns before the cornice is

set. A is the iron column, B the T-bracket cast on it and C the iron beam resting on the T-bracket. Over the iron column A the plate D is laid, and on this plate the channel bar E is placed. To this channel bar E the angle iron bracket shown by F K L M is bolted, and an angle iron, J, bolted along the front edge of the brace F N, as shown. A lower bracket is bolted to the brace F N at I, and to the iron beam C at H. This completes the iron bracket work for the support of the cornice so far as the iron worker is concerned, and it is well to remark in this connection the iron worker and cornice maker should have the same detail to work after, so that when the brackets are finished the necessary allowance has been given to allow the cornice to pass under and over the iron bracket. The iron brackets having been put up in this manner, it will only be necessary to brace the cornice with band iron about ¼ × 1¼-in. in size every 4 or 5 feet. These band iron braces should be painted two good coats of metallic paint before inserting into the cornice; this prevents rusting, and also, in some degree, the action of the copper when in contact with the iron brace. The brick wall having been built up to its required hight, and the cornice R S T having the band iron braces inserted as described, being careful that the iron braces are so placed in the cornice as not to interfere with the iron brackets on the building, the cornice is set, having a drip at T. By means of ¼-in. thick copper wire or rod the braces in the cornice are fastened against the permanent iron brackets where it is most convenient to do so, as is indicated by the

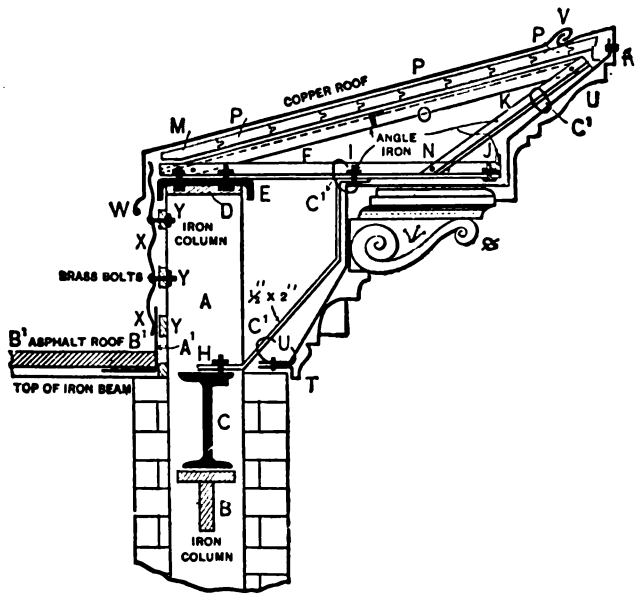


Fig. 199. Cornice Fastened to Angle Iron and Bolted to Structure

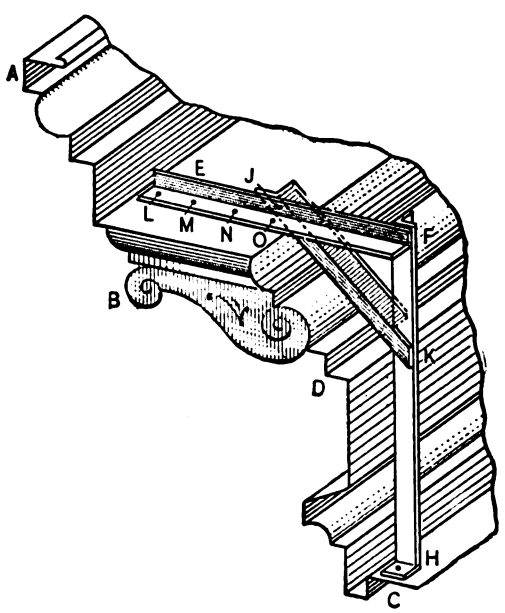


Fig. 200. Supporting Cornice Having Great Projection

loops C′, C′ and C′. If the cornice is in one or more lengths, care should be taken that the cornice rests plumb and level. Where the loops are shown as at C′, C′ and C′, holes are punched in the braces before they are inserted into the cornice; the wire is then passed through these holes and prevents the loops from slipping when fastened to the permanent bracket.

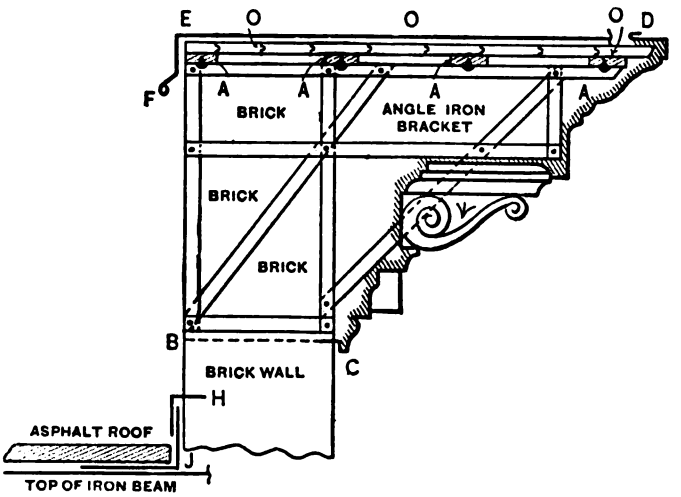


Fig 201. Copper Cornice Supported by an Angle Iron

The cornice being set, the iron worker should bolt or screw $\frac{1}{4} \times 1\frac{1}{2}$-inch iron laths against the iron column A, as shown by Y Y Y in Fig. 199, and holes should be punched about 24 to 30 inches apart in the lath to admit $\frac{1}{4}$-inch bolts.

Assuming that the roof will be of asphalt, after the brick arches have been placed between the iron beams the copper flashing A′ will be placed as shown, after which the asphalt roof B′ B′ is laid. Before the top of the cornice is planked, or, as is sometimes the case, filled with fire proofing or terra cotta blocks, the back of the cornice is covered with corrugated copper, shown by X X, forming a cap flashing over the lower flashing and bolted to the iron laths, through the holes previously punched, by means of brass bolts, and extending up to the top of the cornice. The cross seams should have 2-inch lap and the horizontal seam $1\frac{1}{2}$ corrugations lap, both riveted with copper rivets. When the back of the cornice is completely finished the roof is planked as shown by P P P, or if the top was covered with fire proofing the method would be the same, and the top covered with copper laid standing seam, using cleats fastened by copper nails and locking the front in the edge of the cornice, as at V, and turning down at the back over the corrugated copper, with a bead forming a drip as at W.

It is often the case that a cornice having a large projection is to be fastened to permanent brackets, as just described in connection with Fig. 199; but where the band iron braces would not be able to support the projection, and which would consequently bend over at the crown molding.

To avoid this, angle iron brackets are constructed, similar to that shown in Fig. 200, to strengthen the cornice, and are placed about every 6 or 8 feet apart.

Let A B D C in Fig. 200 represent a cornice having a large projection. Construct a bracket of angle iron sufficiently large for the weight which it has to sustain, as shown by E F H, supported by a cross piece, J K, bolted to the drip at C and to the crown mold at L M N O. When brackets of support are inserted in a cornice, as shown, the band iron braces need not be spaced so close.

Fig. 201 illustrates the method of fastening a cornice to a brick wall by means of iron brackets built in with the brick work, no iron construction running up on the front as in Fig. 199. After the wall has been built over the roof beams about 12 or 14 inches, as indicated by H in Fig. 201, a copper cap flashing is built in, as shown, and over this cap flashing the wall is built up as high as B, on which to set the cornice. Let D C represent the cornice, having a drip at C, with the necessary band iron braces inserted as described in connection with Fig. 119. The cornice in Fig. 201 is now placed upon the wall and fastened temporarily by means of wire to the iron beams, as previously explained in Chapter II. The angle iron bracket shown is then set behind the cornice on the brick wall and fastened by means of loops of copper wire to the band iron braces in the cornice, spaced about 3 feet apart. The wall is then run up, as shown, to the top of the bracket. The temporary wires can be loosened, and the cornice will stand, held in position by the brick wall. Furring strips of wood, A A, etc., are bolted to the top angle iron of bracket, and on them the roof planking is nailed, and afterward covered with copper, E E, either flat or standing seams, bent over the back of cornice, with a drip as shown at F. After the roof beams have been arched over with brick the copper flashing J is slipped under the cap flashing H and the asphalt K put over the flashing J. If the roof was of copper a lock would be bent to the flashing J.

COPPER CORNICE WORK ON FIRE PROOF BUILDINGS—IV

A method is shown in Fig. 202 of constructing and fastening the angle iron brace direct to the cornice, which after being set upon the wall is backed up with brick, the brick wall holding the cornice in position. A is a brick wall, ready to receive the cornice, and B is the cornice, to which the angle iron brace D E F is bolted, the bolts X X X, etc., being of brass. It will be noticed that an upright angle iron, H I, is riveted to the main brace by means of cross pieces J and K, and an angle iron top, L M, having the required pitch for the roof of the cornice is fastened to the main brace at L and P, and by means of the cross bars O and N. Before the brace is bolted to the copper cornice it should receive two coats of

metallic paint. The flange C of the drip is now set upon the wall, and the cornice is fastened temporarily to the iron beams as previously described, and then the wall is run up to the top of the brace P, as partly shown by A′ A′ A′. The wires which hold the cornice should not be loosened or cut until the wall has dried for a few days. A lock is placed at the top of the cornice, as at V, to which the roof covering is locked. A portion of the lock is cut away, as shown from W to Y, so as to show the method which the framer or carpenter should employ in planking the top. Before the braces are constructed, holes are punched in the top piece of angle iron L P, on which, when the cornice is set, the furring strip P is bolted, as shown by U U, etc. On these furring strips the roof planks R S T are nailed, slipping the planks under the lock V. When setting the cornice work together in the shop on which the angle iron supports are to be bolted, take into consideration the hight of the cornice when finished and put the sections together in such lengths as to allow them to be hoisted up on the wall and handled with ease. A case of this kind comes to mind of a cornice 7 feet in hight and 4-foot projection, having heavy angle iron braces bolted on, 4 feet apart, which was put together in the shop in 14-ft. lengths, weighing about 485 pounds to each section. Arrangements were made with the housesmith or iron worker whereby for a certain sum per day the use of the iron worker's derrick was obtained, and the cornice hoisted with ease.

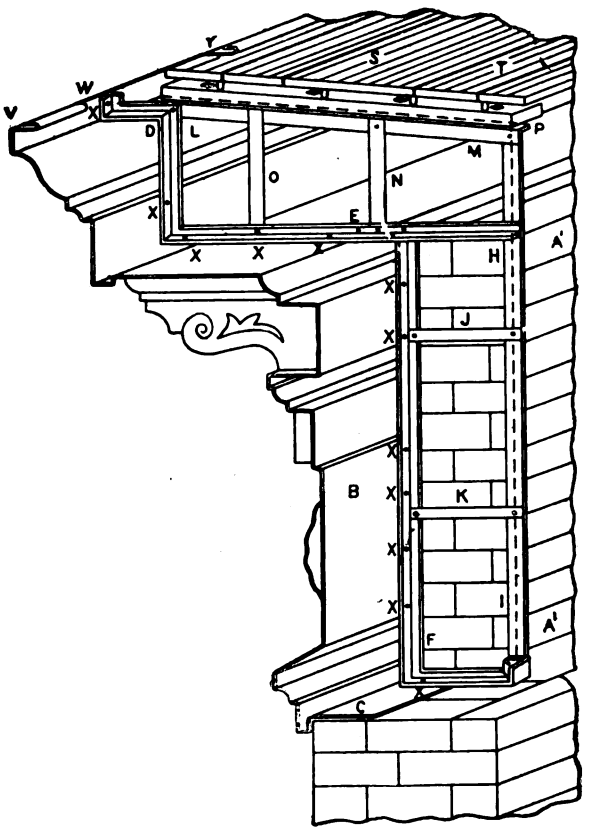


Fig. 202. Angle Iron Brace Fastened Direct to Cornice and Backed with Brick Wall

The method of constructing a mansard gutter over the top of a cornice braced for that purpose is shown in Fig. 203. Let T C represent the terra cotta blocks on which the cornice is to be set, F H being the main cornice, with a drip at H, the top or roof of the cornice extending back as far as T. The cornice being low, it is braced with $\frac{1}{4} \times 1\frac{1}{2}$-inch band iron braces, bolted as indicated in the illustration. The cornice being set and fastened temporarily with wire, the wall is run up and

the plate B is laid throughout the wall as desired. The iron rafter C being bolted in position, as shown by D and E, the wall A A′ is built up as high as required, and on to the iron rafter C iron laths are bolted at O O, etc. Through the holes which were previously punched in the band iron braces of the cornice, screw on the furring strips X X, and on these furrings the gutter board L is nailed. Now set the molding J upon the roof and over the lap T of the cornice, soldering it water tight and soaking the seam, and have a lock at the top of J, as shown at K. Although this method sufficed in the case in mind, on second thought it is suggested that the edge T shown on the roof of the lower molding be turned all the way as a lock, and that the edge on the bottom of the upper molding J be turned in instead of out. For it is much easier to slip this edge in the lock of the lower molding; this lock then prevents the roof of the lower molding sinking, during the soldering operation, due to the heat of the soldering coppers.

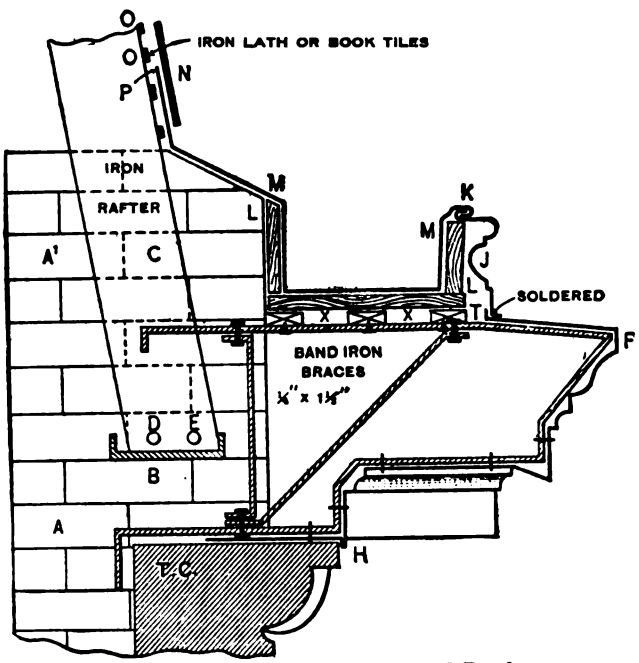


Fig. 203. Gutter for Mansard Roof

Have the framer plank the sides of the gutter as shown at L and L, and then line the gutter, locking and soldering the front at K and letting it extend up under the slate 6 to 8 inches, as at P. The slate N extends over the gutter flange P and is fastened to the iron laths by means of copper wire. It is to be understood, that the bottom plank of the gutter is to be pitched toward the outlet, and suggestions for making the connection of the outlet to the gutter, in fact all necessary details are expounded in Volume II.

Fig. 204 shows the method of fastening copper store cornice in a fire proof manner. C D is the lower iron column, having a T-bracket at H, on which the iron beams I and J rest, and on these iron beams the brick wall K is built up. Over the flange of the lower column the plate E F is laid and the upper column A B bolted to it. L M N O D represents the angle iron bracket bolted to the iron columns.

Holes should be punched in the angle iron at the points indicated by the arrows, so that when the cornice N P is laid against the brace work the brass bolts can be

inserted through the copper cornice and bolted on the inside. The cornice being bolted in this way secures it in a fire proof manner. A drip is left on the bottom of the cornice at P and a lock at the top at S.

Against this drip the window sash X is laid. Below the angle iron brace O is rough boarding, Y, to which the sheet metal ceiling Z is fastened. Over the top of the brace L M N the roof plank ing R R is fastened and on this the copper roofing is laid. The portion of the flashing against the iron column, as at U, is secured as follows: The flashing U is bedded in white lead and holes bored into the iron column at V and W, and threaded so the flashing can be secured firmly to the column. Or holes can be bored without threads, using either style of expansion bolts shown in Fig. 205. Where the holes are counter-sunk the bolt indicated by A is used. When the hole is not counter-sunk use the bolt B. When using the expansion bolt the sockets C C are placed in the holes bored and the bolts turned, which then expand the sockets.

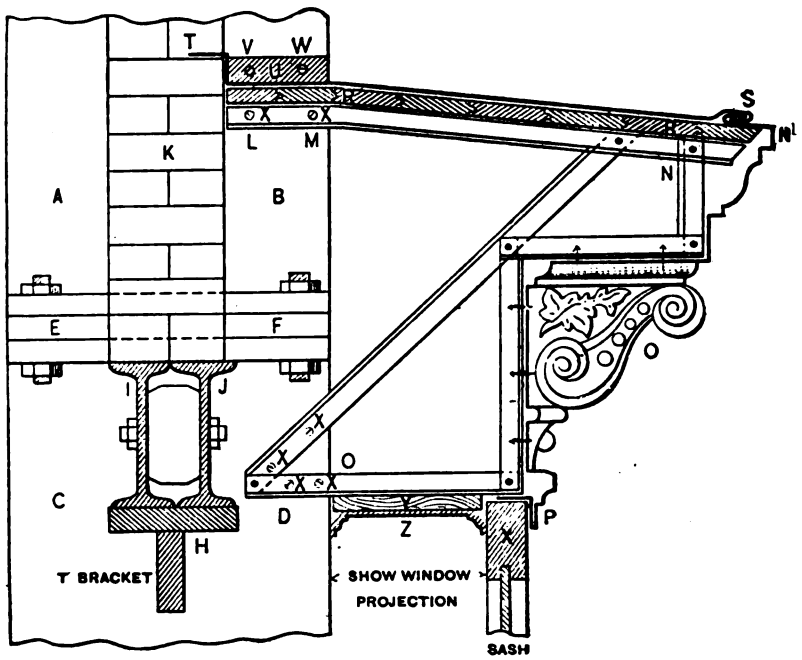


Fig. 204. Cornice Fastened to Store Front

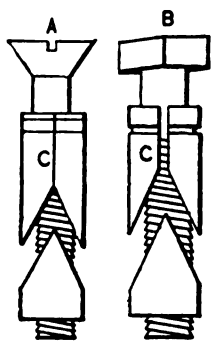


Fig. 205. Two Styles of Expansion Bolts

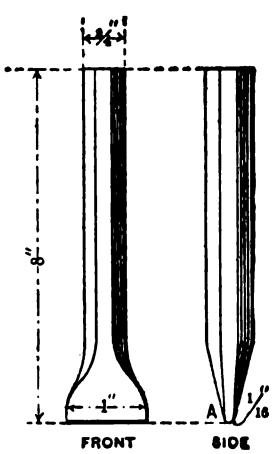


Fig. 206. Two Views of Seam Chisel

As a store cornice attracts the eye, and as the seam can be easily seen, care should be taken when putting it together at the building to obtain a clean and well fitting seam. As it is sometimes difficult to have the members of a molding fit tightly over each other, a seam chisel, shown in Fig. 206, is used. It will be noticed that the chisel is not sharp, but rounded off to about $\frac{1}{16}$ inch. With it and a hammer the seams can be worked tightly together, using the chisel on the inside and holding a piece of wood on the outside, or vice versa.

RAISING CORNICES TO BUILDINGS

In reference to the different ways of raising a cornice and placing it upon different kinds of buildings, the illustrations given in Figs. 207 to 216, inclusive, show the modern methods of placing cornice work on walls, whether these walls are of stone, brick, concrete or frame, or whether the buildings are high or low.

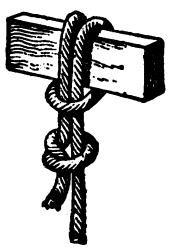


Fig. 210. Method of Fastening Guy Ropes

In some parts of the country the cornice work is put up in sections, nailing, screwing or clinching same against wooden lookouts or brackets nailed against the wall. This is an old method, not at all fireproof and not allowed by the fire underwriters in the larger cities. Another objection to this method is that it requires a large amount of scaffolding on the outside and does not make a good job, as is obtained under the methods adapted to modern building requirements.

In the modern construction of a sheet metal cornice up to 7 or 8 ft. in hight, the hight of the shop allowing, the cornice is usually finished in the shop, with with brackets, modillions, panels and all seams securely riveted, up to 24 ft. in length, and then hoisted on the wall in one piece. When a cornice is to be placed on a single building with a front, say, 25 or even 28 ft. wide, the cornice can be finished in one piece. When the cornice is longer it is usually made up in 24-ft. sections, three 8-ft. sheets, or if a 10-ft. brake is used, in 20-ft. section, two 10-ft. sheets, or if a 7-ft. brake is in use in 21 or even 28 ft. sections, three or four 7-ft. sheets.

A cornice that has been completed in the shop for a 25-ft. front, containing end trusses, is shown in Fig. 207. The wrought iron braces are secured with ¼-in. stove bolts. And care is taken to allow sufficient laps on the cornice

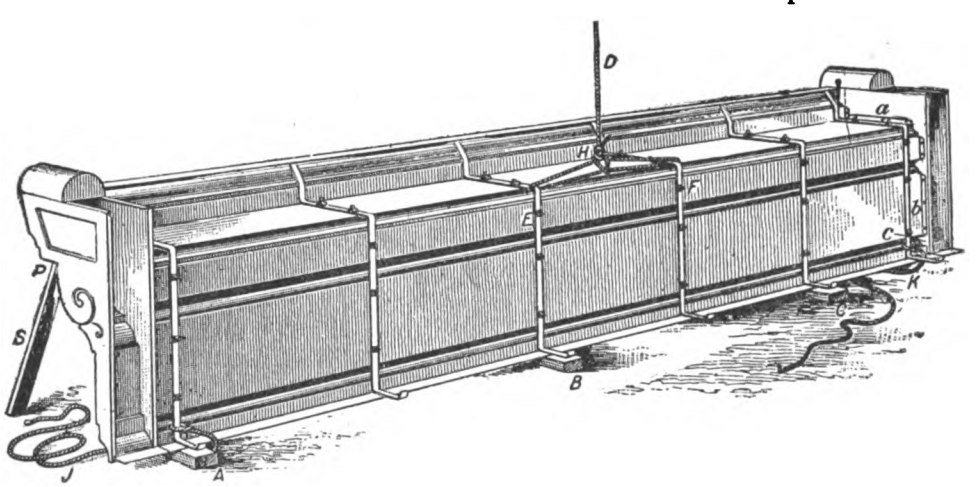


Fig. 207. Method of Attaching Ropes for Hoisting a Cornice

proper, so that it can be well riveted to the side of the truss at *a*, *b* and *c*, as shown. This allows the trusses to be firmly grasped when loading the cornice on the wagon previous to transporting to the job. For carrying the cornice on the wagon a special rack is used as wide as the wagon, consisting of a frame made of 2-in. oak stuff a trifle higher than the tailboard of the wagon at the back, and another about 6 in. higher than the seat and placed behind the front seat; also another frame placed central between these two. On these three frames a platform is laid, fastened to the frames with hook and eyes, and on this platform the cornice is laid. If a rack of this kind is not at hand the cornice can be transported by laying a 4×4-in. joist across the seat and rear end of the wagon, and on this lay two long ladders, secured to the wagon with ropes. Then over these ladders the cornice is laid and secured. Arriving at the job, the cornice is carefully unloaded, with its back toward the wall on which it is to be placed, care being taken that three or more blocks or bricks are placed under the iron braces, as indicated by A, B and C, and alongside the back of the drip, as indicated by B in Fig. 208. This keeps the drip *b* true and level, the weight of the cornice resting on the block B. When these blocks are forgotten and are not placed under the braces and the cornice is set on the rough and uneven ground, usually found at a building, the drip is buckled and dented by the weight of the cornice, as indicated in Fig. 208 by C.

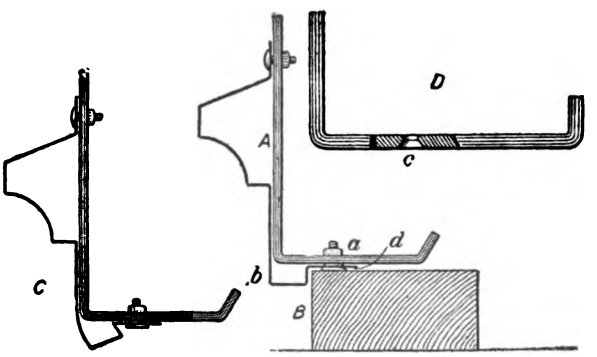


Fig. 208. Things to Avoid and Provide

Another point to bear in mind is always to countersink the hole on the under side of the brace A where it is bolted to the drip flange at *a*, in a manner indicated by *c* in D, Fig. 208. This allows for a smooth surface where the flange rests on the wall at *d*, and allows the sliding of the cornice this or that way without loosening any bricks, which would be liable if the bolt head projected below the flange surface. Having placed the cornice in Fig. 207 on the blocks above referred to, use two or three wood braces, as indicated by S, to hold the cornice in an upright position, previous to hoisting upon the wall. The hoisting of the cornice is accomplished by means of what is known as the cornice maker's derrick, as shown placed in position on the roof in Fig. 209, and consists of a triangular frame made of seasoned oak, having a wrought iron cap placed over the top at A and a wrought iron base placed over the two legs at B and C, with sharp spikes

attached to same, which take a firm hold and prevent the derrick from slipping when the weight of the cornice is pulling upon the derrick. A crank shaft is shown at D, around which the hoisting rope is wound by means of the handles E and F. A heavy iron band is secured around the top of the derrick at *a*, to which the guy ropes are fastened. This style of derrick is usually employed in the largest shops in New York City.

It is convenient and light in weight and can easily be hoisted to the roof through the well holes in the building. It can be used on a ten-story building, as well as a four-story, the only difference being in the length of the rope. The pulley H, the handles E and F and the crank shaft D are removable, thus reducing the weight when pulling up or lowering the derrick to and from the roof.

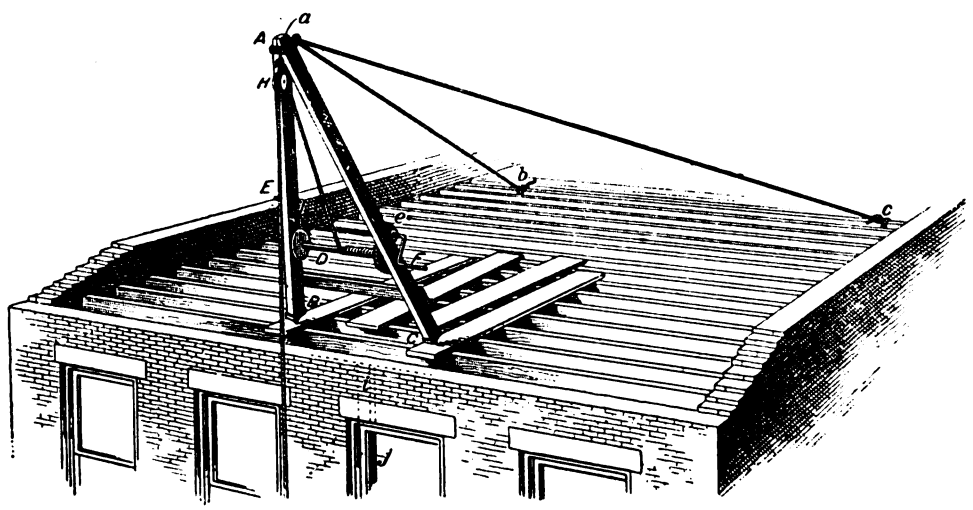


Fig. 209. A Portable Hoisting Derrick Generally Used

Having hoisted the derrick to the roof, set the crank shaft in position, onto which the rope is already wound, and hang the pulley H into the ring at the top of the derrick, as shown, loosen the pawl *e* and draw out enough of rope from the crank shaft, passing the end through the pulley H. Pass the guy ropes through the top ring at *a*, when the derrick is ready to be set up. Nail two planks in the position shown, placing the spikes B and C in the center of the second beam. Set the derrick at its proper angle so that the hoisting rope will project about 10 or 12 in. over the face of the wall, and fasten the guy ropes to beams farther away at *b* and *c*. Should the second beam be too far back, so that the derrick would be at too great an angle to the roof line, planks must be laid out to the first beam and the derrick moved forward.

When fastening the guy ropes at *b* and *c* they can be fastened easily, quickly and securely by using the knot and loop shown in Fig. 207. The derrick being securely fastened, the pawl *e* is lifted, and one man unwinds the rope from the crank shaft D until sufficient rope has been let down to fasten to the cornice braces, as shown in Fig. 210. The hoisting rope is generally fastened to the two center braces; therefore, when bolting these two middle braces in position, the workman should see that they are exactly in the center of the cornice so that the cornice will balance easily when being hoisted. The hoisting rope shown by D, Fig. 207, is now fastened in the angle bends of the two iron braces E and F and securely knotted at H, making a triple loop knot, as shown in detail in Fig. 211, B B representing the iron brace sections.

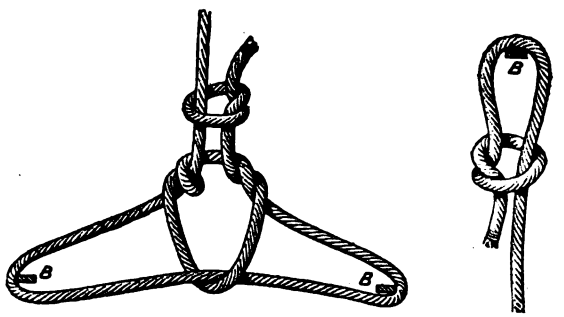


Fig. 211. Triple and Single Loop Knots

When the rope D in Fig. 207 is drawn taut there will be a side strain on the two braces E and F. To avoid this, some shops use an oak truss as shown by A, B, in Fig. 212, with a heavy iron band and ring C around the center, also two hooks bolted over and around the top of the truss as shown. This truss avoids the tying of ropes around the braces in hoisting and any side strain. As the iron hooks D and E are stationary, the braces in the center of the cornice always must be bolted according to the dimensions between the two hooks D and E. While the rope D in Fig. 207 carries the weight, the cornice must be guided in its ascent by means of the two guy ropes, J and K, which are fastened to each end brace at the foot molding. The ropes should pass on the inside of the brace, on each side and the tie be made by means of a loop knot shown in detail in Fig. 211. Everything being in readiness the cornice is hoisted by turning the handles E and F in Fig. 209, care being taken that the cornice in Fig. 207 will not suddenly swing against the wall of the building, when it is raised off the ground, as it has a tendency to do because the cornice usually rests on the sidewalk much farther from the wall than the hoisting rope in the pulley above. As soon as hoisting has begun, the guy ropes J and K should be taken in hand, one man on each side, and the cornice steadied so as to avoid striking the wall in its ascent.

When the front wall has been cleared of scaffolding this hoisting is an easy matter; but when the masons' scaffold still remains then the derrick shown in Fig. 209 must be set on the first beam so as to allow the pulley to project farther

over the face of the wall without getting the inclination of the derrick at too great an angle, as it would do if kept on the second beam. When the cornice is heavy and the strain in guiding from the street is severe an extra prop is placed from the bottom of the roof beam to the next story below, as indicated in Fig. 209 by *i j*. The appearance of the cornice after it has been hoisted in its proper position previous to being slowly lowered on the wall, is shown in Fig. 213. The guy ropes A and B, which were used in guiding from the street, are now drawn up on the roof without loosening the knots *c* or *d* and are used at C and D to steady the cornice. The top of the wall being clear, the handles H and J are slightly turned, the pawl E raised, and the cornice lowered slowly and carefully, the handles being held firmly at each side, so that the weight of the cornice will not jerk the handles away until the drip sets nicely over the face of the wall as indicated by *a* at the top of Fig. 213. Then the pawl is lowered. Now by means of the ropes C and D, the drip is drawn tightly against the wall as indicated in the detail, and galvanized wire is used to fasten to the braces along the foot molding as shown in Fig. 214 and nailed with wall hooks to the second beam A. This draws the drip tightly against the wall throughout the entire length of the cornice.

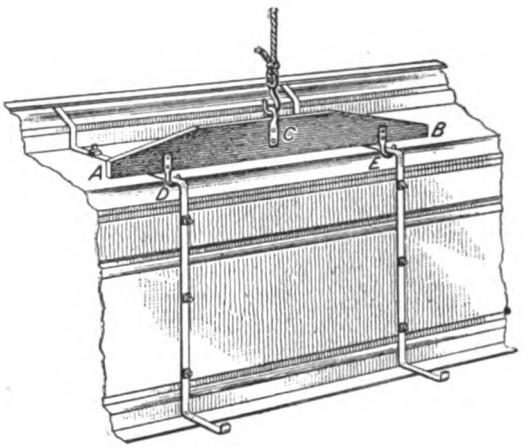


Fig. 212. Oak Truss to Avoid Straining Braces in Hoisting

Do not loosen the hoisting rope from the cornice until the wires have been fastened to all other braces at the top as shown from C to D. Before drawing these wires taut, the cornice must be plumbed by use of the plumb rule B, set against the outer line of truss, or any other vertical line of the cornice. If the wires are not taut enough, a rod hammer handle, etc., can be inserted between the wires, as indicated at X, on each brace and turned until the wire twists around itself and makes it shorter, thus drawing it taut. When this has been done, loosen the hoisting rope in Fig. 213 and place two wires on the two braces to which it was attached, which completes the fastening of the cornice. Care should be taken to have holes punched in the braces to admit the fastening of the wires as indicated in the detail F in Fig. 214, which shows a hole punched in the foot brace at *a* and another on the planceer line at *b*.

To make a fire proof job anchors should be attached to the braces below the planceer line, as shown at *e*, *e*, *e*, etc. This is done at the building, as shown in

the detail F. Small angles, *c*, are bolted to the braces in the shop; then the anchor H is bolted to *c*, the bolt passing through *c* and *d*. If the mason is not able to wall up the back of the cornice the same day it is set, then provision must be made to secure it against any wind storm which may arise overnight. The cornice being secured against wind from the back, it must be secured against the wind lifting the cornice from the front and throwing it on the roof. This is done by cutting wood braces and setting them under the anchors *e* and nailing to the roof beam at the bottom. When a large run of cornice is to be set and the cornice is not very heavy all the sections are hoisted up in one place and carried and set on the wall where required. If, however, the cornice is too bulky to carry around the wall, the

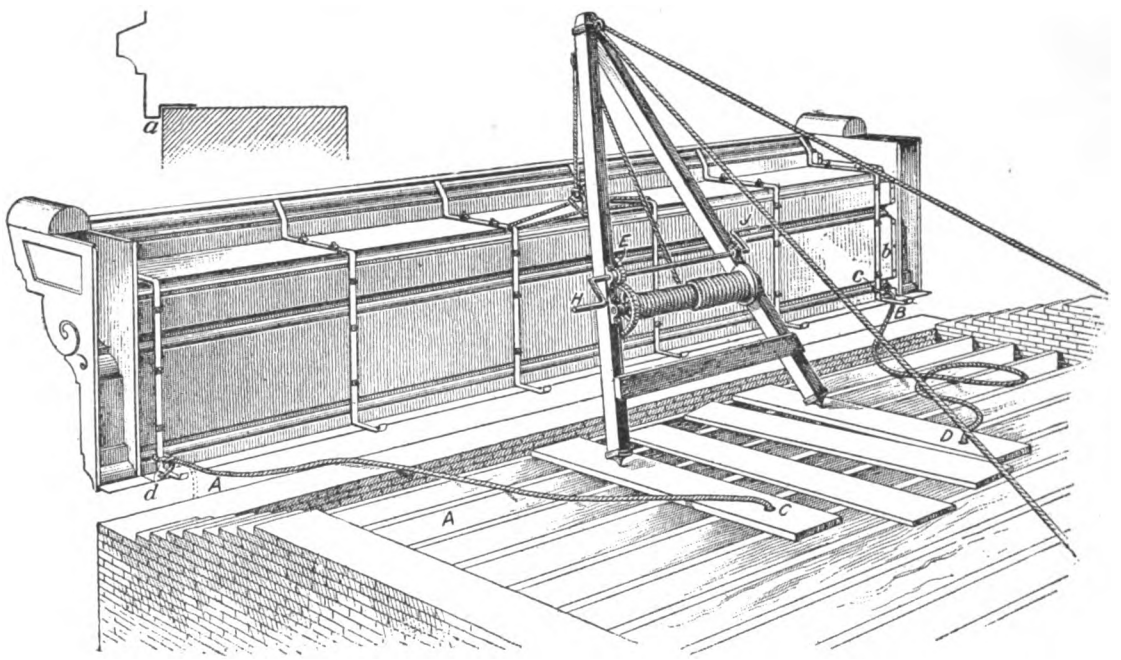


Fig. 213. Cornice Raised and Ready to Be Placed on Wall.

derrick must be shifted from place to place, setting the sections where required, as before explained. The derrick is now taken down, allowing the rope to remain wound around the crank shaft. Care should be taken that no acid gets on the rope, for a few drops of acid are liable to burn the strands and may cost the loss of life or limb and the expenses of making a new cornice and repairing other damage, should the rope break and the cornice fall.

The cornice shown in Fig. 214 should now be backed up by the mason up to the planceer line C D, which firmly builds in the anchors and secures the cornice in a fire proof manner. The top of the cornice is now planked by the framer, ready for the roof covering, which is locked into the lock along the top of the

cornice. Sometimes the cornice to be put up is very light, so that the derrick just described need not be used, hoisting the cornice by means of a rope and pulley, as shown in Fig. 215. In this case, using any pieces of joists at the building, a stand is made, as indicated by *a b c*, over which one or two joists or planks turned upright are placed, putting a few nails at *a*, *b* and *c* and fastened to the beams at *d* with a loop knot. The pulley A is then tied at the top *e* and the rope B used in the usual manner.

When a large heavy cornice is to be set on a high building of iron frame construction arrangements can be made with the contracting iron worker to allow the use of his derrick crane, shown in Fig. 216, for hoisting and setting the cornices on

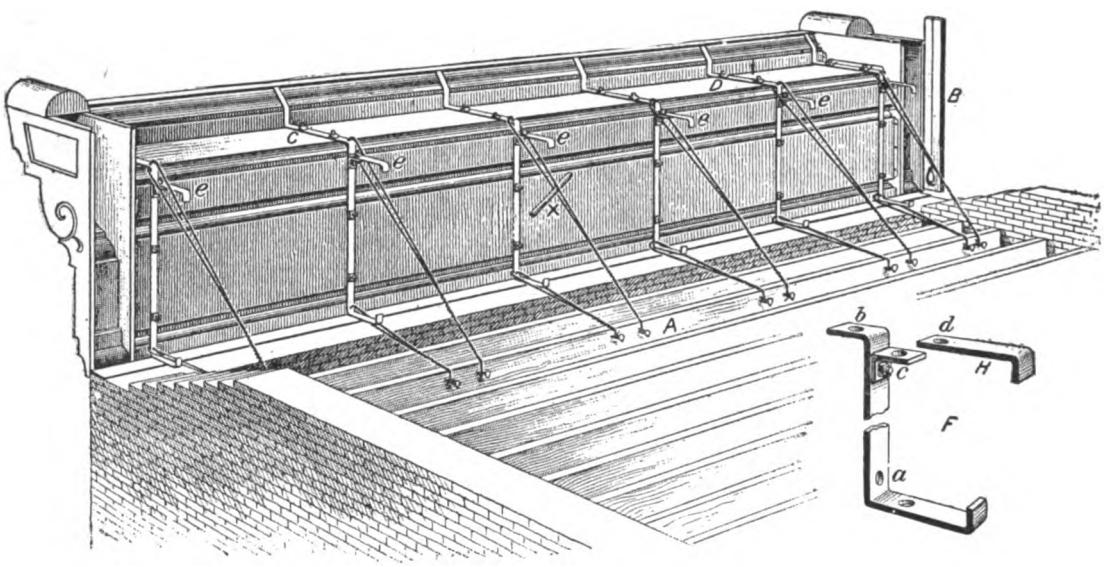


Fig. 214. Method of Fastening Cornice to Building

the wall. As this derrick had been previously used for setting the iron roof beams, it is already in place on the roof and can be used to advantage, because it can be swung out from place to place. When the wall is clear, as shown, the wires of the cornice are fastened to the iron beams by means of clamps, indicated in A, in which B is the beam and C the clamp, bolted together at *a*, with a hole for the wire, as shown at the top. When the cornice is secured by the wall these clamps can be loosened and used over and over again. On most fire proof structures the angle iron framing behind the cornice is already in place; in that case it is better to have the cornices hoisted in shorter lengths, to enable the cornice worker to handle the sections to better advantage.

Every job presents different difficulties, but no matter how high or low the building may be, whether of stone, brick, concrete, frame or iron construction, and

even if the iron worker's derrick cannot be used, the cornice maker's derrick, shown in Figs. 209 and 213, in connection with the truss shown in Fig. 212, is the best derrick yet constructed for the cornice worker's use. If the walls are constructed

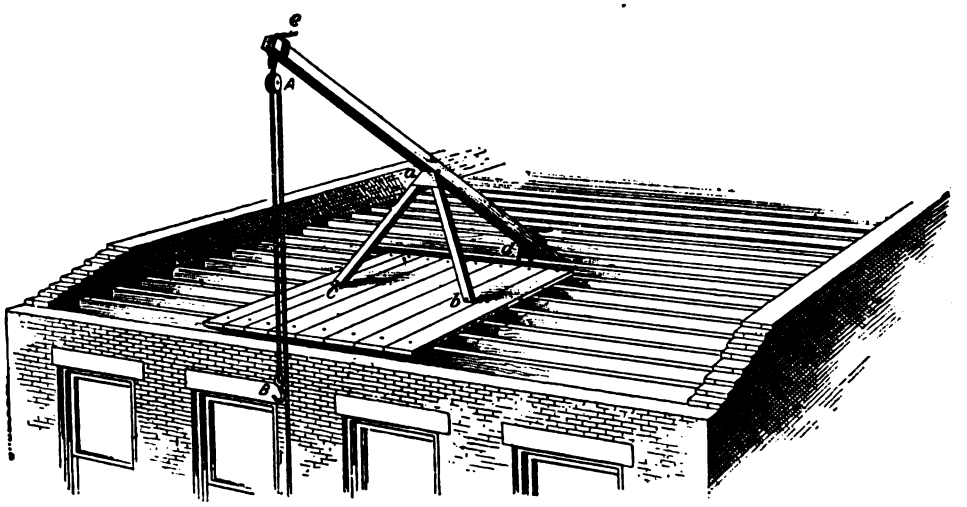


Fig. 215. Emergency Derrick Made at Building for Raising Light Cornices

from concrete it is only necessary to have a level surface at the top, as indicated by E F in Fig. 216, or if of wood frame construction it is only necessary to have the wall plate clear to receive the flange of the foot molding. It is necessary always to have a drip on the lower molding, whether the cornice is used over a show window

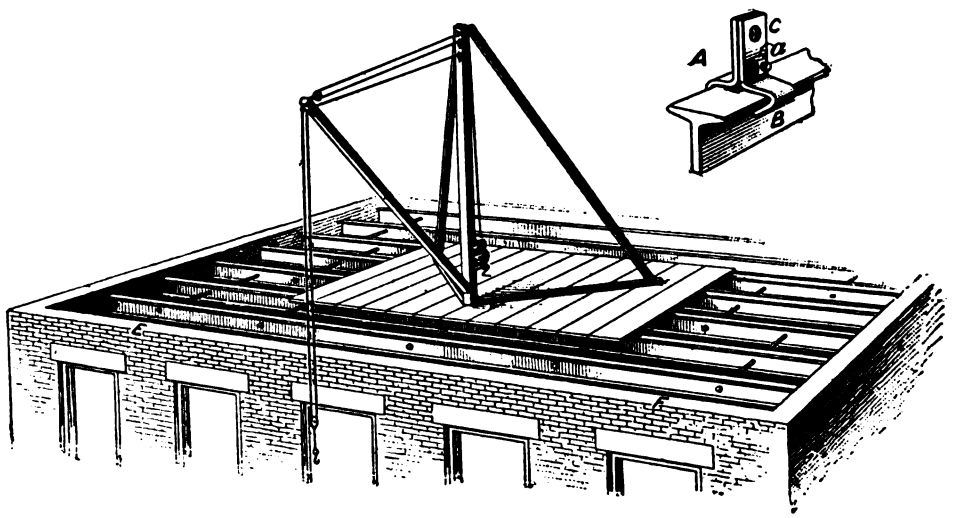
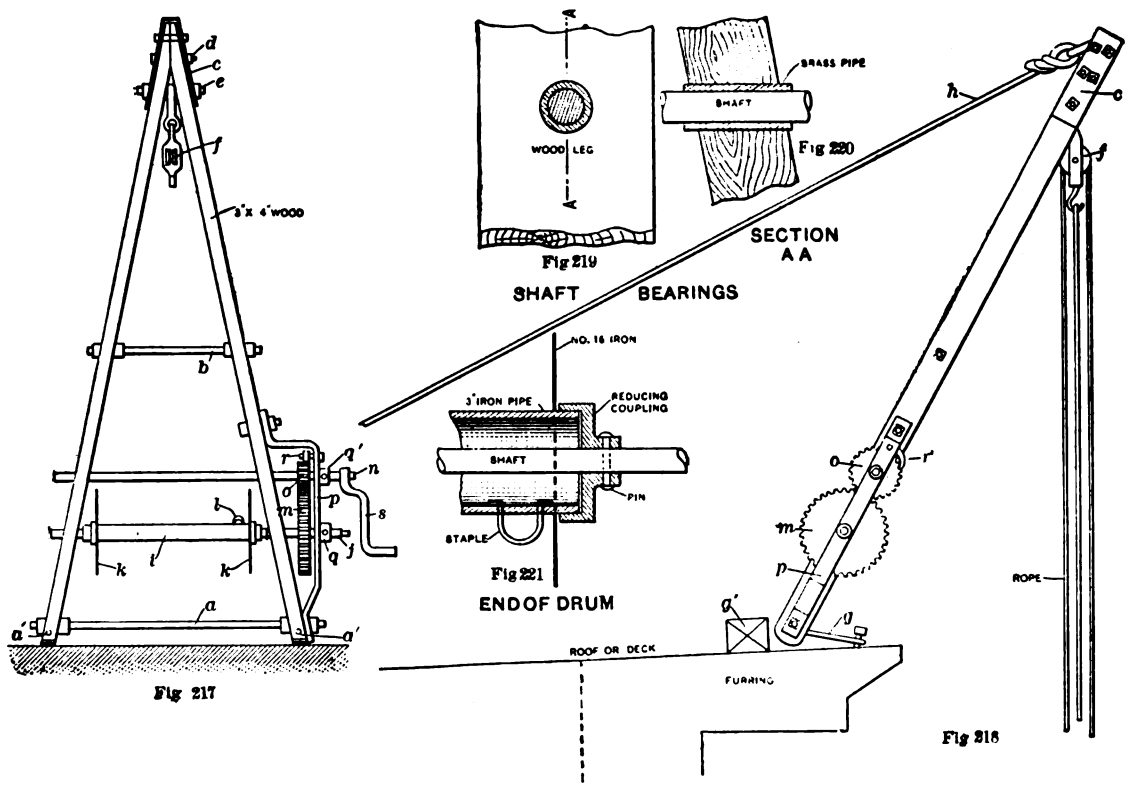


Fig. 216. An Iron Worker's Derrick Sometimes Used.

or for a sill or lintel cornice, as this drip prevents the water from flowing between the joint inside of the building and resulting in a leak which is never found, because it is always looked for on the roof of the cornice or building.

A CORNICE DERRICK

A device which will prove very convenient to every cornice maker, but which is not owned by every one, is illustrated herewith. It is a derrick, or hoisting device, of simple construction, and can be made in any shop, with the exception of the cog wheels, which can be bought very cheaply from some dealer in second-hand machinery. A front elevation is given in Fig. 217, and Fig. 218 is a side elevation, which also shows the derrick in working position on a roof. Figs. 219, 220, 221 are details showing how different parts of the device are constructed.



Details of a Cornice Derrick

It will be seen that the derrick consists of two shear legs separated at the bottom, but coming together at the top, with a stay rod near the bottom end of the legs, and another stay rod about midway, which holds the legs in an inverted "V" shape. For ordinary use the legs should be made of hard wood, about 3×4 inches in section and 10 feet long. The bottom ends of the legs should be about 4 feet apart, and the stay rod *a* should be made of 1-inch round iron, with a thread cut on each end long enough to allow the use of nuts and washers on both sides of both legs. The

rod, of course, passes through holes bored in the center of the legs and within about 4 inches of the bottom ends. In order to prevent splitting, ⅜-inch bolts, *a'*, should pass entirely through the bottom ends of the legs, below and at right angles to stay rod *a*. The midway stay rod, *b*, can be made of ¾-inch round iron, threaded and secured on both sides of each leg by nuts and washers in the same manner as the bottom stay rod. The legs should be mitered together at the top and reinforced with a No. 16 sheet iron saddle, *c*, through which should pass four ⅜-inch bolts, *d*, also the main hanging bolt *e*, from which the rope tackle *f* is hung.

The method of using the derrick is indicated in Fig. 218. The derrick should first be set in an upright position near the edge of the cornice or roof, and secured by ropes or wire, *g*, or a block, *g'*, which prevents the foot from slipping. The guy rope *h* is attached to an eye in the top of the derrick, and secured at its other end to the rafters or some convenient place on the roof, the length being adjusted so that the top of the derrick will lean out over the edge of the building, as shown. It is best to attach the main rope tackle before the derrick is tilted out. Material can then be hoisted by a man standing either on the ground or on the roof. The guy rope *h* can be provided with a tackle block, so that when the material is drawn up to the level of the roof, or if it is a cornice that is hoisted, when it is up high enough to be secured in position—the guy tackle can be hauled in, thus swinging the material onto the roof or the cornice into position.

As it is often necessary to hoist heavy material, a compound drum, *i*, will be found very useful. A very simple method of constructing this drum apparatus is as follows: Make the main shafts *j* of 1-inch round iron, journaled to the shear legs, as shown; the drum *i* of 3-inch iron pipe, slipped over and connected to the shaft *j* by means of 3 × 1 in. reducing flanges, screwed on the ends of the pipe *i* and pinned to the main shaft *j*, to prevent the turning of the drum on the shaft. Flanges, *k*, can be made of No. 16 sheet iron cut to fit the 3-inch pipe and slipped on the same before the reducing flanges are screwed on. Two ¼-inch holes should be drilled in one end of the 3-inch pipe drum and a staple, *l*, secured therein, which is necessary for holding the end of the rope. The large pinion *m* should be keyed to the main shaft *j*.

The driving shaft *n* should also be of 1-inch round iron and journaled to the shear legs in the same manner as shaft *j*, and have mounted on its end the small pinion *o*, which, of course, meshes with the pinion *m*. The relative size of pinions *o* and *m* should be about 4 to 1, to secure the positive meshing of the pinions and prevent an endwise movement of the shaft. Strap *p*, drilled to be bolted to the shear leg below the shaft *j*, is then offsetted and drilled to receive the shaft *j*, extends

up and is drilled to receive the shaft n, and then passes on up about 2 inches above the pinion o and bends over toward, foots up against and is bolted to the shear leg.

Collars q and q' are set screwed to the shafts, thus preventing longitudinal movement. Dog r is pivoted to brace p and engages the teeth of the pinion o, acting as a ratchet to prevent the unwinding of the drum i when the crank s is released. The crank s should be removable and the end of the drum shaft j squared, so that for light loads or when the rope first begins to wind around the drum i the crank can be used directly on it, which enables the drum i to be turned much faster, until enough rope has been wound on to increase the diameter so that the resistance is increased sufficiently to require the use of the crank on the shaft n.

PUTTING UP GALVANIZED IRON CORNICES—I

The difference in construction of galvanized iron cornice work in different shops is quite important. Those accustomed to the methods of construction employed in the West would be very much at a loss in putting up work manufactured in the East, while those who know how to proceed with the latter would be considerably embarrassed in handling work manufactured in some of the interior towns. Variations in construction, as between different sections and different factories, prevail in other lines as well, but there is always a right and a wrong way, and where several plans are offered, one is generally better than another.

In Fig. 222 is shown a cornice constructed upon wooden lookouts, or brackets, and put up in a manner which experience has shown to be quite satisfactory. The brick work A is leveled off on a line with the bottom of the foot molding, and this member, B, is then set by means of the lookout C, and a strip of board, D, is nailed upon the top of them.

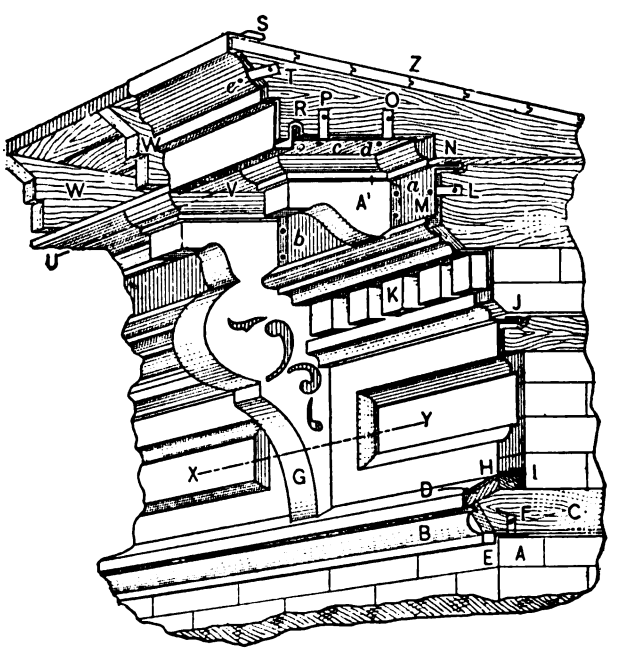


Fig. 222. Putting Up on Building on Wooden Lookouts with Locked Joints

The foot molding is formed with a drip, as shown at E, which is drawn tight against the wall and fastened to the lookout C by means of the strap F. These straps are made of No. 24 galvanized iron, 2 inches wide and as long as required. An angle of 1-inch iron is riveted or soldered to the foot mold, and the top is nailed to the wooden lookout C at F. The object of the board upon the top of the lookout is to provide a solid base for the foot of the bracket G.

After the foot molding has been put in place the brick work is carried up to the top of it between the lookouts, and then the bracket G is put in place, being fastened temporarily in a plumb position by any means most convenient, the usual method being to solder the foot of the bracket directly to the top of the foot molding, and then, by a wire attached to the top of the bracket, to fasten it to the wall temporarily. The panels X and Y are next placed in position, and are fastened to the bracket G by means of a locked joint, as shown in Fig. 223, which is a section through X Y in Fig. 222. G, in Fig. 223, represents the bracket, on which the edges are bent inward on the sides, as shown by A, while the edges are

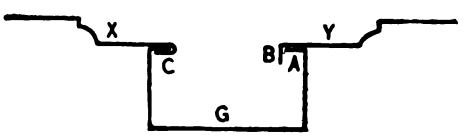


Fig. 223. Locking the Panels—Section Through X Y in Fig. 222

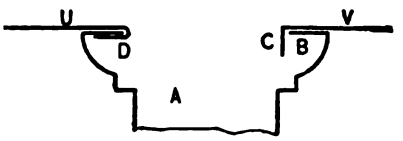


Fig. 224. Locking the Planceer—Section Through U V, Fig. 222

turned outward on the ends of the panels, as shown by B. After a panel has been slipped in place the edge B of the panel is turned over the edge A of the bracket, thus locking the two parts together, as shown at C.

Along the bottom of the panel Y, in Fig. 222, an edge is turned inward, as shown at H, which, meeting the edge turned upward on the top of the foot molding at I, serves as a gauge for obtaining a true line for the panel and a means of fastening it to the mold below. The two flanges are then locked together, as shown at I, and tacked with solder at intervals, thus securing a water tight joint. After the panels have been placed in position in this manner the brick work may be carried to their top. In case the panels are very high, straps should be riveted to them at intervals and secured to the brick work, thus holding them in position.

When the brick work has been carried to the top of the panels the dentil course, into which the dentils K had been fastened before the work was hoisted to the top of the building, is put in position. The lower edge of the dentil course fits back against the edge which has been bent on the top of the panels, as shown by J, thus forming a gauge by which it may be readily placed, and also forming a

means of joining the two sections together from the back, which is done as described in connection with the foot molding.

After the dentil course has been placed in position the brick work and lookout may be carried to the top of it, as shown, when the strap L is riveted at M and nailed at L. In practice it is better to fasten the modillions A^1 against the modillion course on the ground, leaving the planceer *c d* loose, to lie flat upon the modillions and the brackets, and to be fastened in position afterward, rather than to fasten it upon the moldings on the ground. Thus the modillions A^1 can be riveted, as at *a*, on the ground before the molding is hoisted, or they can be riveted from a scaffold when putting up the work on the wall, in the same manner as the flange *b* of the bracket is riveted. Slight irregularities will occur in work of this kind, and it is therefore better to place the planceer on the modillions and brackets after they are in position, when it can be shifted one way or the other, as may be necessary to provide a straight line along its outer edge, against which to hook the crown molding at R.

The planceer, it will be noticed, is locked to the modillion course at N, strapped to the lookout W at P and O, and riveted to the planceer at *c* and *d*. Along the outer edge of the planceer an edge is bent upward, as shown at Fig. 223. The planceer may be joined to the modillions and brackets by cutting through the center of them and turning down the edges and bending them around so as to clinch with the edge in the top of the modillions and bracket, as shown in Fig. 224, in which A is the cap of the bracket, with the edges of the cap bent inward, as shown at B. U V represents the planceer, cut out in the center, with edges bent downward as at C, after which it is clinched as at D. Instead of cutting out the entire size of the modillion and bracket, and joining in this way, only a portion of the iron should be cut away, so as to leave as much strength in the planceer as possible.

The next step is to place in their position, in Fig. 222, the main lookouts W W W. The last operation in putting up the cornice is to hook on the crown mold, as is shown at R. The strap T is riveted to the ogee of the molding at *e*, and fastened to the lookout at T. A lock is placed at S to connect the roofing. While some cornice makers have different ways of putting up this class of work, this method gives good strength in the joints and makes a water tight job, as it allows for expansion and contraction. and no nails are driven into the face of the cornice.

No cornice maker who has pride in the quality of his work will allow a cornice to be simply nailed to the face of the wall, for it will bring reproach upon the sheet metal cornice trade, and will have an appearance which is anything but satis-

factory to the owner or a recommendation to the cornice maker. It often happens that work is fastened to the outside, after the walls are up, because the cornice was not done on time, which is a poor excuse, when the quality of work is taken into consideration.

PUTTING UP GALVANIZED IRON CORNICES—II

In the large cities the use of galvanized iron for cornice work is prohibited unless erected upon iron supports. It may be well to call attention here to some general features of this kind of work. In the first place the entire cornice up to 6

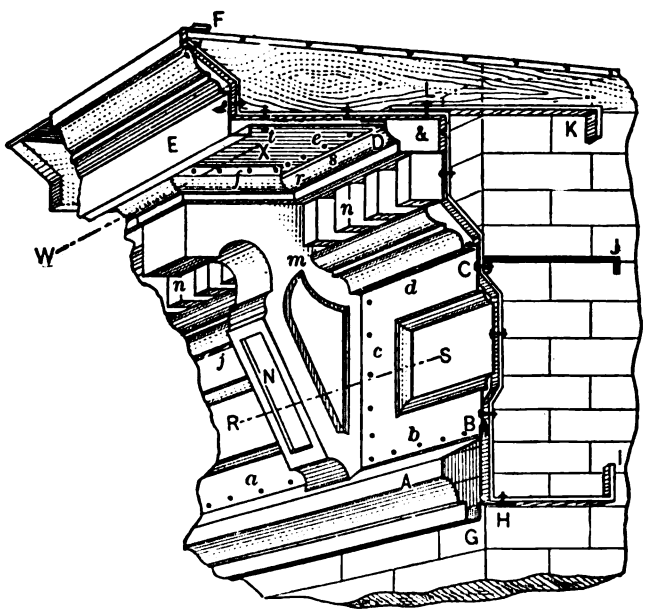


Fig. 225. Cornice Set in Fireproof Manner

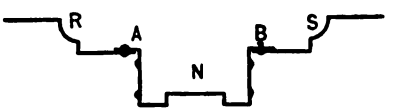


Fig. 226. Riveting the Panels —Section through R S in Fig. 225

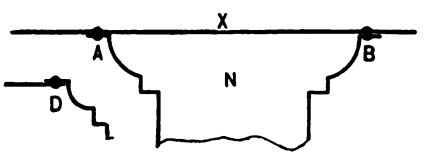


Fig. 227. Riveting the Planceer —Section through W X in Fig. 225

feet in hight is made complete on the ground, or in the shop. If the job is in the same town where the shop is located the cornice is finished complete in the shop, while if the job is outside and the cornice must be shipped the work is put together in parts in the shop, shipped and assembled in one piece on the ground, as described below.

In Fig. 225 is shown the method of constructing a cornice on wrought iron brackets or lookouts. The foot molding A is first placed upon the bench, and the bracket N placed in position. It will be noticed that the foot mold has an edge bent upward, as shown at B. The bracket has an edge bent outward on each side, as shown in Fig. 226, in which N represents the bracket with edges or flanges bent

outward, as shown by A and B. To these the panels R and S are riveted at A and B. The brackets being all placed in position in Fig. 225 the panels R and S are next placed, with an edge bent outward at the top and bottom, as shown. The lower edge rests upon the wash of the foot molding, taking out the buckles in the face of the panel, and is riveted to the flange bent upward on the foot molding, as shown by B. The letters *a*, *b* and *c* indicate how the rivets are spaced, about 2 to 3 inches apart, 2-pound tinned rivets being generally used.

After the panels are in position the dentil course is hooked onto the edge which has been bent outward on the top of the panel, as shown at C, and riveted along *d j*, as shown. The brackets are now soldered to the dentil course, where they intersect at *m*, and the dentils *n* are soldered in their proper positions. It will be noticed that at the top of the dentil course on the cap mold a flange has been bent outward, as at D. To this the crown molding and planceer, which have been formed in one piece, are riveted, as shown at D. A small edge has been bent toward the outside on the rear of the planceer, as shown by *r s*, which, when riveted, rests tightly against the cap mold, thus insuring a stiff joint, and at the same time taking out the waves and buckles in the flat surface of the planceer *e*. The crown mold E has a lock bent onto the top at F, to which the roofing is joined.

The method of fastening the cap of the bracket to the planceer X is shown in Fig. 227, in which N indicates the bracket, X the planceer and A and B the flanges bent outward on the cap of the bracket and riveted, as shown. In some cases, where the crown mold and planceer cannot be formed in one piece, it is customary to form the crown mold E, in Fig. 225, with the drip and flange as far as *t*, separate pieces being placed between the brackets, riveting to the flanges *t* and D and to the cap of the bracket, as shown by D in Fig. 227. By using pieces between the brackets in Fig. 225 the piece of metal covering the top of the bracket is saved. Where a cornice is constructed of copper it is well to plan the joints before laying out the cornice, as a vast amount of material can be saved in this manner. The same applies to the top of the modillions.

The cornice having been constructed on the ground, as above described, the next step is to insert the wrought iron lookouts or braces. These braces are made from $\frac{1}{4} \times 1\frac{1}{2}$-inch flat iron, bent to the required shape according to the detail drawing from which the cornice has been laid out. An anchor, I, is bent directly on the brace, a few inches less in length than the thickness of the wall, with holes punched where shown by the bolts. These holes should be 5-16 inch in diameter, so as to admit $\frac{1}{4}$-inch bolts. Flat headed bolts should be employed, and the holes in the braces countersunk so as to leave a flat surface on the outside of the cornice.

The braces should be placed not more than 4 feet apart, standing and blocking up the cornice temporarily on the foot molding until the braces are in position.

By means of a small stoneman's derrick the cornice is next hoisted in place, the usual lengths hoisted at one time being 24 to 28 feet, according to the weight of the cornice. Where the cornice is longer the vertical seams are put together when the cornice sets on the wall. The cornice being set on the leveled wall H, the rope from the derrick is slackened, but not removed until the cornice is thoroughly fastened, as follows: The drip G is drawn tightly against the wall by means of wire and fastened to the beam or wall. A wire is then fastened to the brace at & and drawn taut until the cornice sets perfectly plumb, when the anchors J and K are bolted in position, as shown at C and L. When the cornice sets true and plumb the wall is carried up, as shown, firmly securing the anchors I, J and K.

On top of the leveled wall K the wooden lookout L is placed to receive the roof for the top of the cornice, and between these lookouts the brick wall is carried to the underside of the roof boards. In case of fire the only portion to burn would be the roof and lookout L, while the cornice would remain as long as the wall stayed in place.

PUTTING UP GALVANIZED IRON CORNICES—III

It is often the case that a cornice, say ten feet high and four feet projection, cannot be hoisted and set on the wall in one piece. It must, therefore, be made in two sections, as shown by 1 and 2 in Fig. 228. The lower section A is placed upon the wall B in the usual manner, the iron brace having the anchor B extending into the wall at the bottom, and the anchor C at the top. Another anchor is placed in position, as at D. The wall can now be built up to the top of the lower section, as shown by C. It will be noticed that the metal from the dentil course F is carried up and turned over, as shown at G, which allows the the locking of the upper section, as shown.

The wall being carried up flush with the top flange and anchor C, the upper section 2 is set over the lower section, having a drip, as at E, the flange of which goes between the lock G, as shown. The iron brace H is placed in position, as before described in Part II, before the cornice is set, having the anchor G attached to the main brace. When the cornice is properly set and fastened, the anchor J is put in position, after which the wall is carried up as high as K, ready for the iron or wooden lookouts to receive the roofing boards. In this manner a cornice of any hight can be set, dividing it into as many sections as is desired.

In some of the larger cities the law compels the use of galvanized iron cornices over all show windows or store fronts. The method which is usually employed in fastening these store cornices is, however, distinctly non-fireproof. In Fig. 229 is shown an illustration of the method now in vogue, in which A shows the top frame of the show window projecting from the line of the wall 12 inches, as required by law. After the show window is in place the ceiling boards B are placed in position, as shown. After this the cornice C, in which the brace D has been placed in the shop, is set on the ceiling boards. The drip E is high enough to hide the joint between the ceiling boards and frame A. As shown at F, a small angle is bent at the bottom of the brace to support the cornice. The drip is

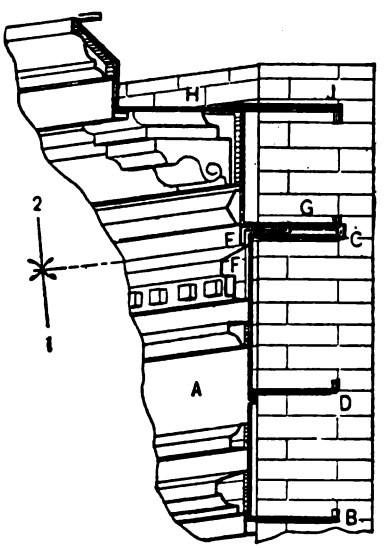


Fig. 228. Setting Cornices in Two Sections

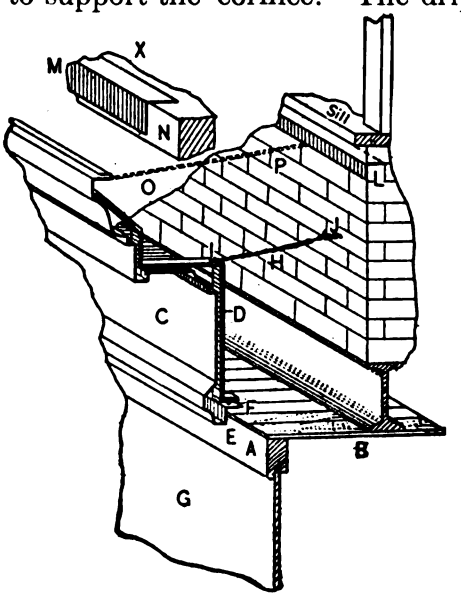


Fig. 229. Non Fireproof Method of Putting Up Store Cornices

drawn tightly against the top frame A and nailed through the flange, as shown at F. Through the hole in the brace I a wire is fastened, as shown by H, and then fastened to the wall by means of the wall hook J.

So long as there is no danger of fire the cornice remains, but as soon as a fire occurs and the glass G is broken and the frame A and ceiling boards B begin to burn, thus weakening the frame A, the cornice comes down with a crash and defeats the object for which it was intended. If simple wrought band iron supports were constructed, as shown in Fig. 230, the danger of accident would be avoided, as no matter whether the wooden frame was burned the cornice would remain the fireproof construction which it was intended to be.

The explanation of this construction, in detail, is as follows: A A represents the iron beams which span the opening of the store on which the brick wall rests,

as shown by F. One-half-inch holes should be drilled into the flange of the beam at D about 3 feet apart. Then the iron supports, shown by C and made from $\frac{3}{8} \times 1\frac{1}{2}$-in. band iron should be bolted to the flange 3 feet apart, as shown at D,. the support passing through the wall a few courses above the beam, as at B, and being turned down at E. Knowing the thicknesses of the wall and the hight of the beam and brick work, these supports can all be gotten out in the shop by the iron worker. Along the front, in a true line, an angle iron, H, should be run the entire length of the building or cornice, bolted, as shown at I, to the two bands of the support. Holes to admit $\frac{1}{4}$-in. bolts should be punched at intervals of about 3 feet along L L of the angle, then when setting the cornice, partly shown by J, upon the angle iron L L bolts could be put through the flange of the drip, as shown at *a*. Of course band iron braces must be inserted in the cornice, care being taken to make the drip M deep enough so as to pass the frame N under the same. When the drip is bolted the cornice should be drawn plumb by means of heavy wire passed from the brace in the cornice through the hole *b* in the support, or band iron straps could be bolted to the cornice at *b*.

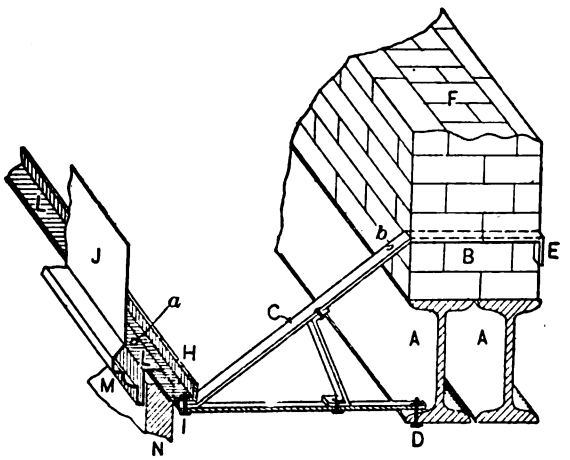


Fig. 230. Wrought Iron Supports for Fire Proof Construction

In this manner the cornice would be free from any woodwork support. When planking the top of the cornice for the roofing, iron or wooden supports are sometimes used. Assuming that O P, in Fig. 229, is the pitch of the roof, care should be taken to have a cap flashing, L, built in as the work progresses below the sill, as shown. This is better shown in diagram X, in which N represents the brick course and M the cap flashing which is to be built in.

PUTTING UP GALVANIZED IRON CORNICES—IV

In Figs. 231 and 232 is shown one method by which a cornice can be attached to a brick building, using wooden lookouts for the purpose, the lookouts being secured without removing any of the brick work. In the side elevation, A represents one of the lookouts, which is fastened to B with nails, screws or bolts, as may

be desired. To secure the lookout to the wall a hole is first drilled, then the bolt D passed through the piece of wood B and through the wall, being secured by means of the nut. In the front elevation the piece of upright wood is indicated by B′, the bolt by D′ and the lookouts by A′. To secure the foot molding to the wall, a strip of board (C) of the proper width can be nailed to the wall and the foot molding nailed to this. If the mortar joints in the brick work are not adapted to holding the nails, it may be found necessary to cut out the mortar and drive in wooden plugs into which the nails can be driven. In some cases it may be found convenient to remove an entire brick, its place being filled with a piece of wood of similar size, the same being held in place by means of mortar or cement. Another method of securing the lookouts is shown in Fig. 233. The top of wall is removed so as to

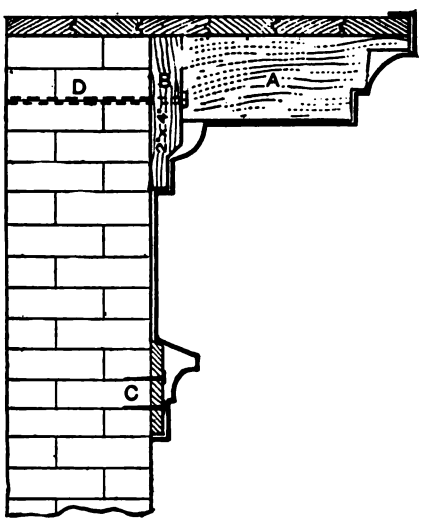


Fig. 231. Side Elevation of Wooden Lookout Secured to Wall

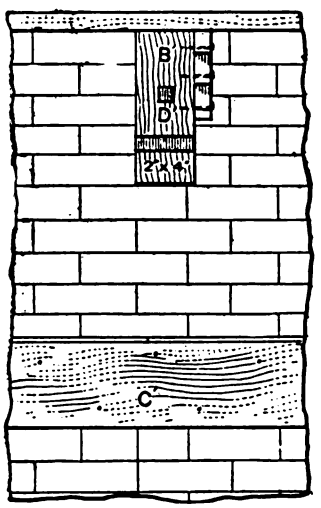


Fig. 232. Front Elevation of Wooden Lookout Secured to Wall

allow the lookouts to be placed in position, when they can be set in brick in the usual manner.

If it is desired to use iron lookouts for the cornice, they can be so constructed as to conform to the general outlines, the cornice being secured to the lookouts by means of bolts. As shown in Fig. 234, at E can be driven an eye for holding the lookout at this point. The eye can be made from $1\frac{1}{2} \times \frac{1}{4}$-inch iron, and say about 7 inches long, with a suitable hole at the end for a bolt to pass through, and drawn out like a wedge at the other end. The mortise in brick or mortar joint should be cut as true as possible, and only a trifle wider than the eye. Pieces of thin board can be put in above and below the eye so it will hold when driven. When driving the iron eyes a round punch can be put in the hole to prevent its being closed by the force of the hammer blows. The lookout has a hole in its end at E, and is to

be secured to the eye by means of a bolt. The top of the lookout iron can extend down over the wall and be secured to the brick or roof as may be required.

When a cornice is required to be placed around the corner of a building, it is

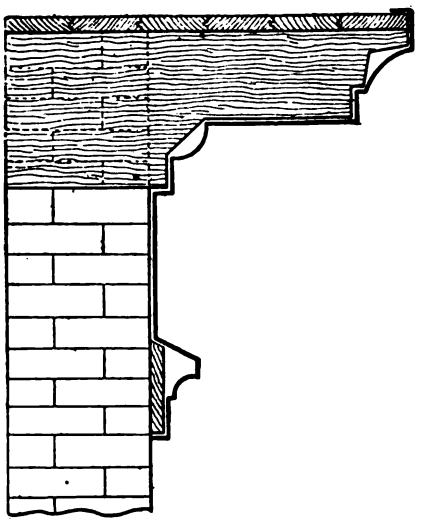


Fig. 233. Wooden Lookout Placed on Top of Wall

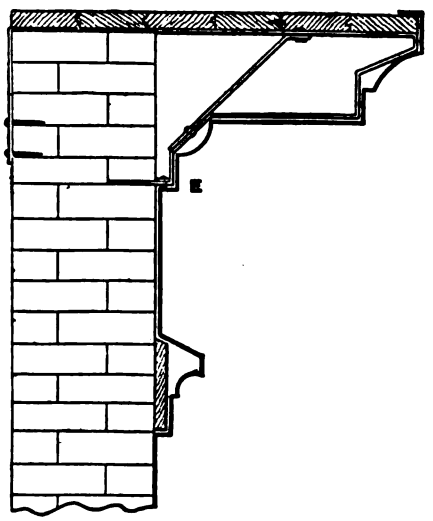


Fig. 234. Iron Lookout Secured to Wall

sometimes convenient to use a lookout that will support the ends of the covering boards where they meet at the corner miter. This lookout is required to be of a different shape from those made to conform to the general profile of the cornice, as shown in Fig. 235. Therefore, let A B C be the profile or elevation of cornice shown in plan by D E F G H J. The wall line is represented in elevation by A C, and in plan by J H G. The lookout A B C is intended to project at right angles to the building, as indicated by D J or F G of plan. If a lookout is required to occupy the place indicated by E H of plan, the pattern can be obtained as follows: Draw the plan in line with the elevation, and from the points in the profile of lookout drop points, cutting the miter line E H, as shown by the letters *a b c d*. At right angles to the wall line A C draw E′ H′, and measuring in each in-

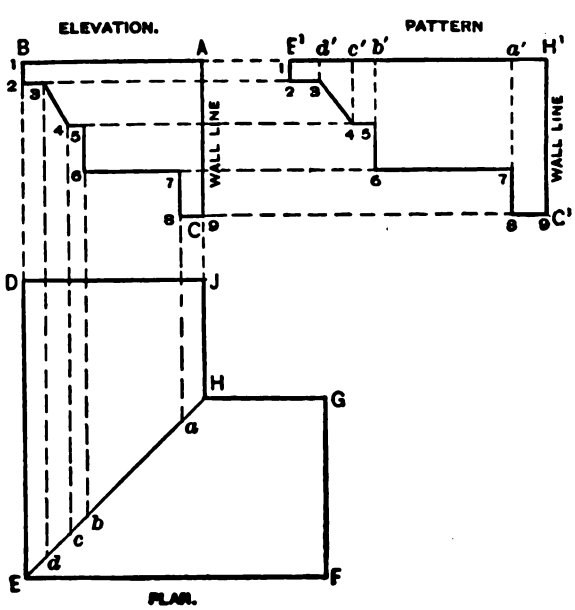


Fig. 235. Method of Laying Out Corner Bracket

stance from H′, set off similar points in H E of plan, as shown by H′ *a*′, H′ *b*′, etc. From points thus obtained in H′ E′ drop lines parallel with H′ C′ which intersect with lines drawn from similar points in B C of profile. Lines traced through the points of intersection as shown by E′ C′ will form the desired pattern. The face parts of the lookout as, 1 2, 3 4, 5 6, and 7 8, are to be cut on the angle indicated by D E F of plan in order that they may fit into the angles formed by the various parts of the cornice.

CRATING SHEET METAL WORK

In shipping manufactured articles, carloads can often be packed in such a way as to insure safe delivery of the work without serious damage. But from the nature of articles constructed from sheet metal, with soldered joints and the like, some injury must result from handling the work, however carefully it may be managed. Cornice makers should not intrust pieces of work, which have cost labor and in which valuable stock has been consumed, to transportation without adequate protection. It certainly does not add to the good appearance of the article to have it crushed and torn, hence a few remarks on crating seem justified.

The size of the parts in which any given piece of work is constructed determines materially the convenience with which it may be crated, as well also as the rate of freight to be charged for its transportation. In general terms, the rates of freight increase with the bulk of the work. In other words, given a very heavy but compact article weighing 100 lbs., and given a structure of sheet metal, as, for instance, a dormer window also weighing 100 lbs., the latter occupying perhaps twenty times the space of the former, the rate of freight charged upon it must be higher than on the former. In other words, rates of freight must be proportioned in part to the bulk of the article or the space occupied. To crate a large article, as a dormer, adds somewhat to the space it occupies. Accordingly, it is found advantageous, so far as shipping is concerned, to construct the work in small pieces in order to crate it more compactly.

A package made by means of furring strips, say 2×1 in. in size, is much more economical to use than boxes, and there is considerable skill and ingenuity to be exercised in packing a given lot of cornice work in a manner to insure its safe transportation.

The putting up of a crate of moldings is a comparatively simple matter; brackets may be set together side by side, in a way to form a compact and some-

what solid package, but when the long, scraggly arms of a dormer window or of a pediment, to say nothing of the odd shapes involved in finials, pinnacles and the miscellaneous ornaments that go to make up an ordinary job of cornice work, are encountered, some care and great skill are required to make satisfactory packages. It becomes quite as much a trade to securely crate and protect work for shipment as soldering or forming the parts ready for joining. The importance of this department is very generally underrated by manufacturers of architectural sheet metal work, but the slightest attention to the subject must convince any one of its value.

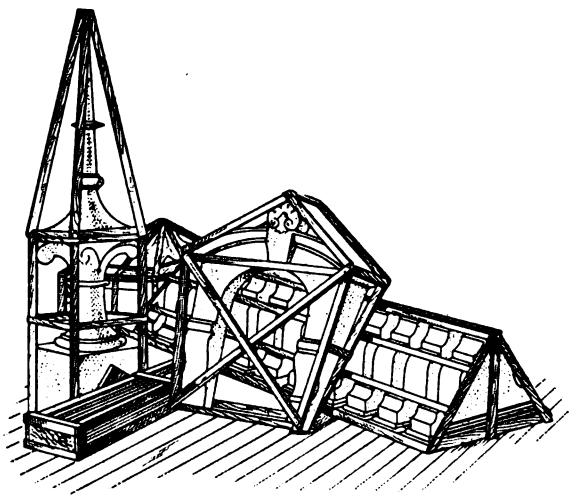


Fig. 236. Crating Sheet Metal Work

Some sheet metal contractors prefer to send the work in a cut and formed condition to the building where it is to be employed, equipping a temporary field shop, instead of shipping the completed article of sheet metal. Shipping the work in this shape demands boxes for protecting it rather than crates. The molding, of course, may be crated as stated before, but the small parts composing the brackets and odd ornaments or the like are better tied in bundles by wires and then packed in boxes protected by sawdust or shavings.

A system which manages the construction of cornices by means of slips, the original slip being made out in the pattern drafting room, and following the work through its several stages until completion and finally becoming the guide by which it is packed and shipped, is of considerable importance in the packing department. It is desirable to keep any man or any set of men, in whatever department they may be employed, constantly busy. Accordingly, there must be an abundance of work in that department at all times. This in the packing room, as well as any other division of the establishment, will necessitate a man working, first upon one job, then on another; this even applies to those firms who do not have constant need of a packer, for then he would be busily employed in more intricate work, that of keeping several jobs in the home town supplied with material. In other words, it will be impossible for him to finish up one given order, whatever may be the class of labor that he is performing, before undertaking another.

Several jobs must dovetail into each other in order to keep the entire establishment moving. Accordingly, in the packing department it is necessary for the packer, from marks upon the work, to be able to distinguish one job from another in order that the proper pieces may be got together. To crate together a part of order 99, which it will be imagined goes West, with a part of order 100, which is to go East, would result in an error not only extremely annoying, but quite expensive. In an extensive business it is impossible for the packer to know anything of the work which he is handling other than by the marks on it. Accordingly, if each piece is marked with the number of the order to which it belongs, he has no difficulty in getting all the parts of that order together.

While getting all the parts of an order together in proper shape by means of these marks may seem a desirable consummation, and though this may seem to extend as far as there is any necessity for going, it is found by experience that still other points need attention. It is necessary to know that not only the parts marked No. 99 have been shipped to a certain place, but that all the parts of which No. 99 is composed have gone to that place. In the memoranda, therefore, or slips made out by which to construct the work, a list of the parts composing the order is made out and furnished the packer by which he can check, in order to know when he has got all that belongs to that order.

There is one step further. It is desirable to be able to indicate to the consignee, or the foreman in charge of the men putting up the work, by some plan, not only the number of pieces and parts which compose the work, but also the packages in which they are contained. The transportation company can take cognizance only of the number of packages delivered to them; they know nothing of the contents. Hence, in at least one establishment, it is customary to have the packer keep account of the pieces that go into each individual crate or box. The crates in turn are numbered, and from this record a list is drawn off by which the consignee or outside foreman is informed that a certain order is shipped in so many crates, numbered, for instance, 110 to 125 inclusive, and that the order itself consists of such and such pieces, a list of which follows, each of which is to be found in the crate with its number placed opposite it.

It is comparatively little trouble, after all, to maintain a system like this in an establishment which is conducted in a systematic manner. The saving in time by avoiding errors and by making the outside managing man entirely familiar with their work, showing them of just what it consists and just where it is to be found, is a matter of very considerable importance.

Of course, in the case of cut and formed work, it would be impossible to indi-

cate in what boxes certain pieces are to be found. For it, there remains no better plan than to unpack the whole lot on its receipt at the building and sort it up by the numbers marked upon the pattern pieces. However, to unpack the whole lot of a job—for instance, a court house—which usually has a tremendous amount of sheet metal work in comparison with the size of the building, which was shipped complete in order to select the parts wanted for certain places, would be a matter, in many cases, impossible to perform for lack of space to spread the work. It is therefore advisable to use considerable forethought and plan to make and ship just those parts immediately required as the work on the building progresses. Were the work all unpacked for the entire job at one time, large injury must result to it on account of exposure from the time it was opened until it was wanted for erection.

The illustration, Fig. 236, shows a job of cornice work crated for shipment in a manner described herein. The operation is not at all complicated. All the qualifications, aside from the handy use of a few tools required, are care and a knowledge of what strains the work is able to endure. As remarked, it is a trade which, to a certain extent, must be learned. And yet it is not difficult of acquirement.

FASTENING WINDOW CAPS

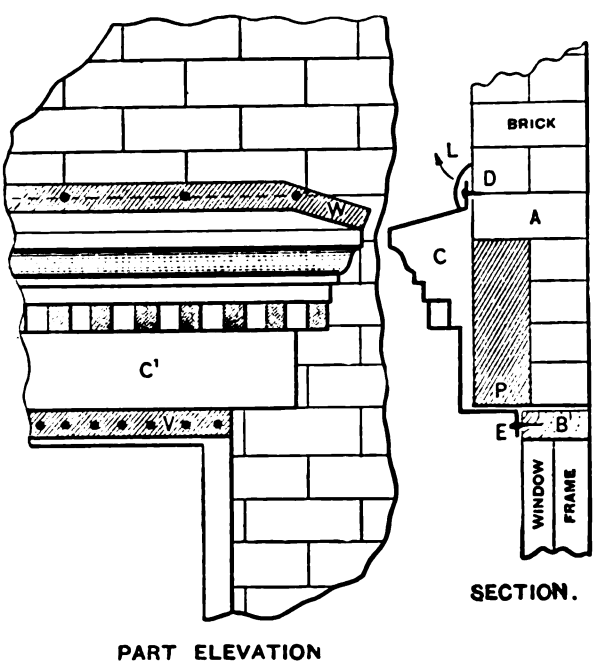


Fig. 237. Details of Fastening Window Caps

For an expeditious method to fasten window caps in place proceed as follows: Referring to the section in the accompanying illustration, Fig. 237, let A represent the brick wall, and B the window frame. C represents the section of the window cap, having a flange bent upward at D and another flange bent downward, as shown at E, while C' shows part of the elevation corresponding to the section. When putting up the window cap, the bottom E should be raised until it is snug against the bottom of the lintel P, and is then tacked by means of a nail driven through the top flange D into the brick wall.

Now use a level and set the window cap perfectly level, after which nail the top flange, as shown in elevation by W in the brick joints. The lower flange V in elevation is then nailed closely to the wooden frame, as is indicated by the dots. It will now become necessary to obtain a water tight joint between the top flange D in section and the brick wall A, which is done by using paint skins or what is known as roofers' cement. This is put on as indicated by the line L, in section, by means of a small trowel and so as to have a smooth surface when finished.